

SURFACE SCIENCE LABORATORIES

P.112

The University of Alabama in Huntsville

XPS Analysis

January 28, 1992

For: Dr. Roger Linton
Mail Code EH53
NASA -MSFC
Huntsville, AL

Samples:

1. MgF_2 Mirror, PPPL: Exposed Region
2. MgF_2 Mirror, PPPL: Unexposed Region
3. MgF_2 Mirror, PPPL: Unexposed Region 2
4. MgF_2 Control : Mirror side
5. MgF_2 Control : Reverse side
6. Vanadium #1, PPPL: Exposed Region
7. Vanadium #1, PPPL: Unexposed Region
8. Vanadium #1, PPPL: Reverse side of sample
9. Rhodium, PPPL: Exposed Region
10. Rhodium, PPPL: Unexposed Region

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(NASA-CR-190089) XPS ANALYSIS Monthly
Technical Progress Report, period ending 28
Jan. 1992 (Alabama Univ.) 112 p

N92-70547

Unclassified
29/25 0077701

Technical Report

The following samples were received from Dr. Roger Linton on Jan 17, 92 through Dr. John Gregory for ESCA analysis. The requested area of interest was in the exposed and unexposed regions of the following samples as shown in the attached sheet following this report and also the reverse side of the MgF₂ Control and the vanadium samples. The information sought is the identification of foreign contaminants.

MgF₂ Mirror, PPPL

MgF₂ Mirror, Control

Vanadium #1, PPPL

Rhodium, PPPL:

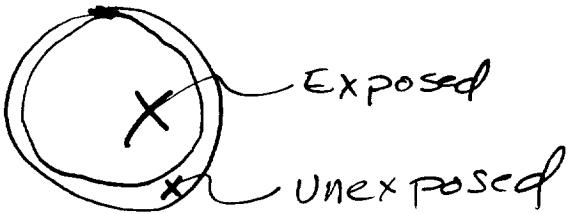
This report contains the results of the samples described above. Each analysis is divided by a GREEN colored separation sheet. For each sample, the first page shows a wide survey scan. The next pages present the quantitative chemical analysis in atomic percent followed by high resolution scans on each of the major component which shows the area used for the quantitative determination of atomic concentrations.

On all the samples except MgF₂ Control Mo, O and C with some Ag were the main species present which more or less completely masked the signal of the substrate from the exposed region of the samples. This has been orally reported to Dr. Linton. However, the UNEXPOSED Region (i.e on the rim) showed the signal from the substrates in addition to some of the impurities mentioned above.

A summary table of atomic concentrations from all these samples is appended to this report.

Ganesh Raikar, (205) 895-6916

Vanadium
#1 PPPCL

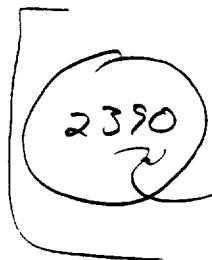
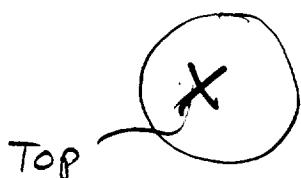


MgF₂
Mirror
PPPCL
Exposed

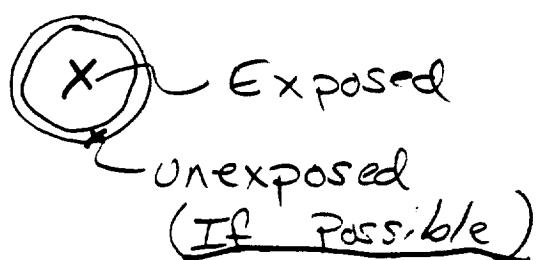
88-91



MgF₂
control



Rh
PPPCL
Exposed



1/17/92 Received by JCG

Submitted as $4 \times 2 = 8$ analyses
PLUS TWO Additional Analyses ~~measured~~
Total: 10 Analyses

Print Delete Page Clear AC
 Summary Entry Right Left Summary
 ====== ====== ====== ====== ======

Page Right Left Summary
 Summary Table Screen
 ====== ====== ====== ======

Exit

Page 1 of 2
 1 of 1 1 of 1

a	File Name	Cycle 01s	Si2p	Nals	C12p	F1s	Ag3d	Mo3d	V3p	Mg2p
	=	=	=	=	=	=	=	=	=	=
Van1_x_5		1 31.42	34.68	1.22	3.29	0.98	0.56	0.71	11.58	15.55
Van1_u_2		1 33.11	33.60	1.52	1.98	1.20	2.59	1.08	10.74	14.18
MgF1_x_2		1 34.19	45.34	0.30	1.14	0.65	0.36	1.08	12.39	-
Rh1_x_2		1 41.63	39.86	0.66	1.01	0.45	0.63	0.28	13.73	-
Rh1_u_2		1 44.55	27.70	15.59	0.87	0.67	1.02	0.00	0.35	-
MgF1_u_2		1 14.92	24.75	1.73	0.88	0.80	33.77	0.30	1.02	-
MgF1_u_5		1 13.95	30.36	2.13	0.52	0.74	30.66	0.45	1.92	-
MgF2_4		1 37.52	41.47	16.39	1.11	0.69	0.33	-	-	-
Van2_2		1 34.02	49.62	1.54	1.04	0.84	0.59	-	-	-
MgF2_2		1 12.74	29.83	1.30	0.60	0.31	24.17	-	-	20.14

Ion Gun: OFF X-ray: OFF Mg
 0.5mPa

Technique: ESCA
 1/28/92 14:40

Print Summary Delete Entry

Page Right
Left Summary Table
Screen Page 2 of 2
1 of 1

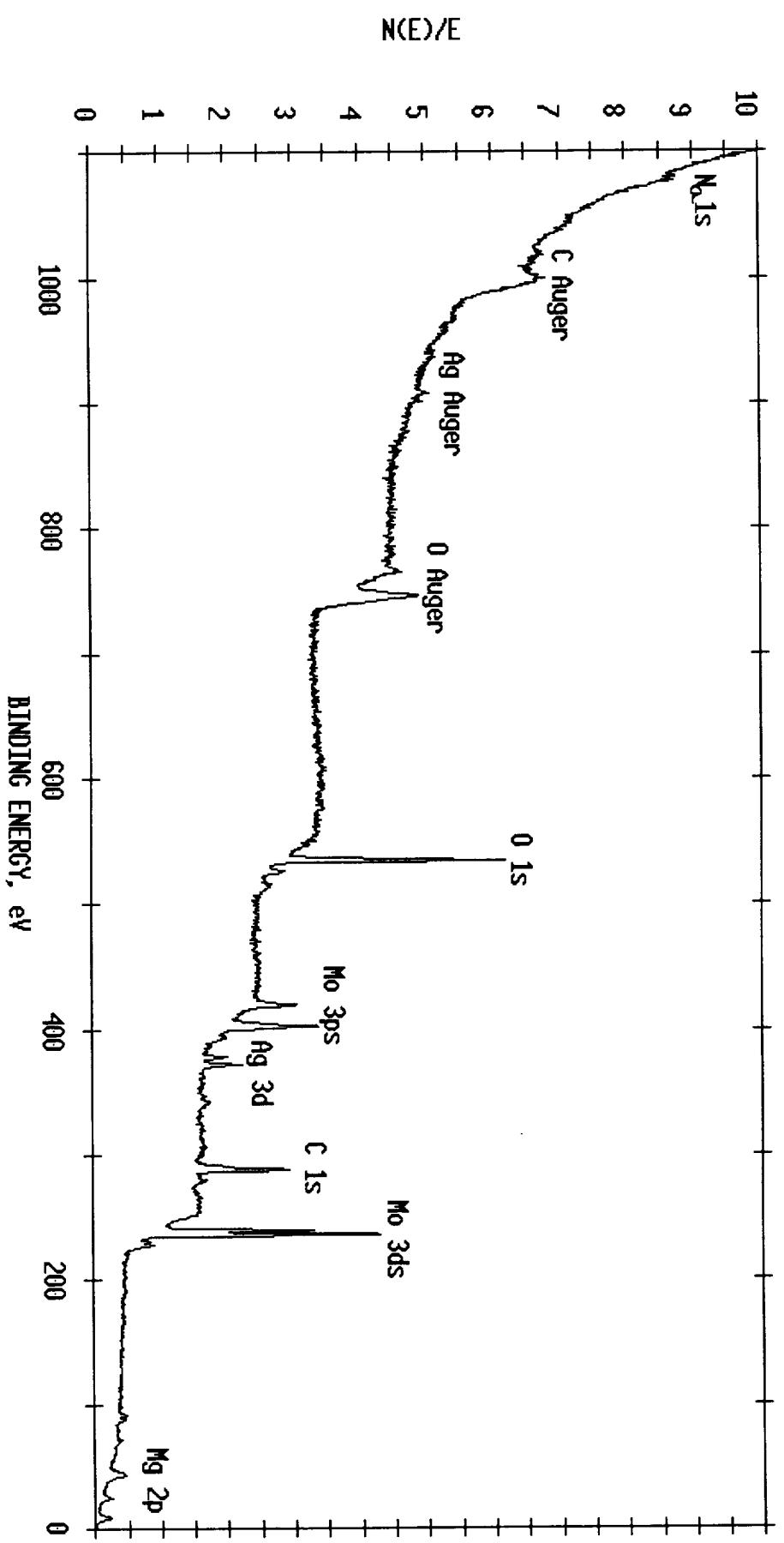
Exit

a	File Name	Cycle Rh3d	N1s	V2p	Al2p
	Van1_x_5	1 - - - - -			
	Van1_u_2	1 - - - - -			
	MgF1_x_2	1 - - - - -			
	Rh1_x_2	1 1.75 - - - -			
	Rh1_u_2	1 9.24 - - - -			
	MgF1_u_2	1 - - - - -			
	MgF1_u_5	1 - - - - -			
	MgF2_4	1 - - - - -			
	Van2_2	1 - 2.49 - - -			
	MgF2_2	1 - 3.74 8.61 - -	1.05	- 9.85	

Ion Gun: OFF X-ray: OFF Mg
0.5mPa

Technique: ESCA
1/28/92 14:40

ESCA SURVEY 1/23/92 ANGLE= 45 deg ACQ TIME=4.59 min
FILE: MgF1_x_1 NASA, MgF2 LDEF, Exposed Region
SCALE FACTOR= 28.803 k c/s, OFFSET= 4.464 k c/s PASS ENERGY= 89.450 eV Mg 250 W



Print
AC Table AC Table

Exclude
Region
Atomic Concentration
Display Curve
More Softkeys
AC to AC Summary
Exit

a User Settings Previous New
c Mode Area Height d Baseline Linear Integrated
e Regions O1 C1 Si1 Na1 Cl1 F1 Ag1 Mo1 Mg2

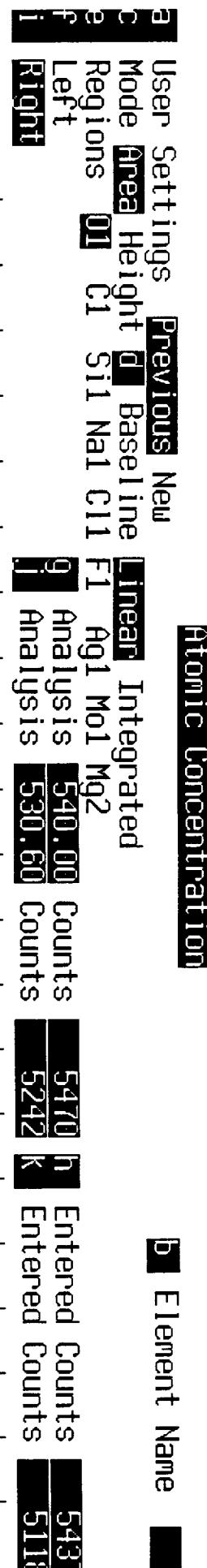
Atomic Concentration Table

File: MgF1_x^2
Lens: Large Area Omni-Focus
NASA, MgF2 LDEF, Exposed Region
Source: Standard

Element	Area (cts-eV/s)	Sensitivity Factor	Concentration (%)
O1s	26136	0.711	34.19
C1s	14430	0.296	45.34
Si2p	108	0.339	0.30
Na1s	2072	1.685	1.14
Cl2p	626	0.891	0.65
F1s	388	1.000	0.36
Ag3d	6970	5.987	1.08
Mo3d	44262	3.321	12.39
Mg2p	748	0.153	4.55

Ion Gun: OFF X-ray: OFF Mg
0.5mPa

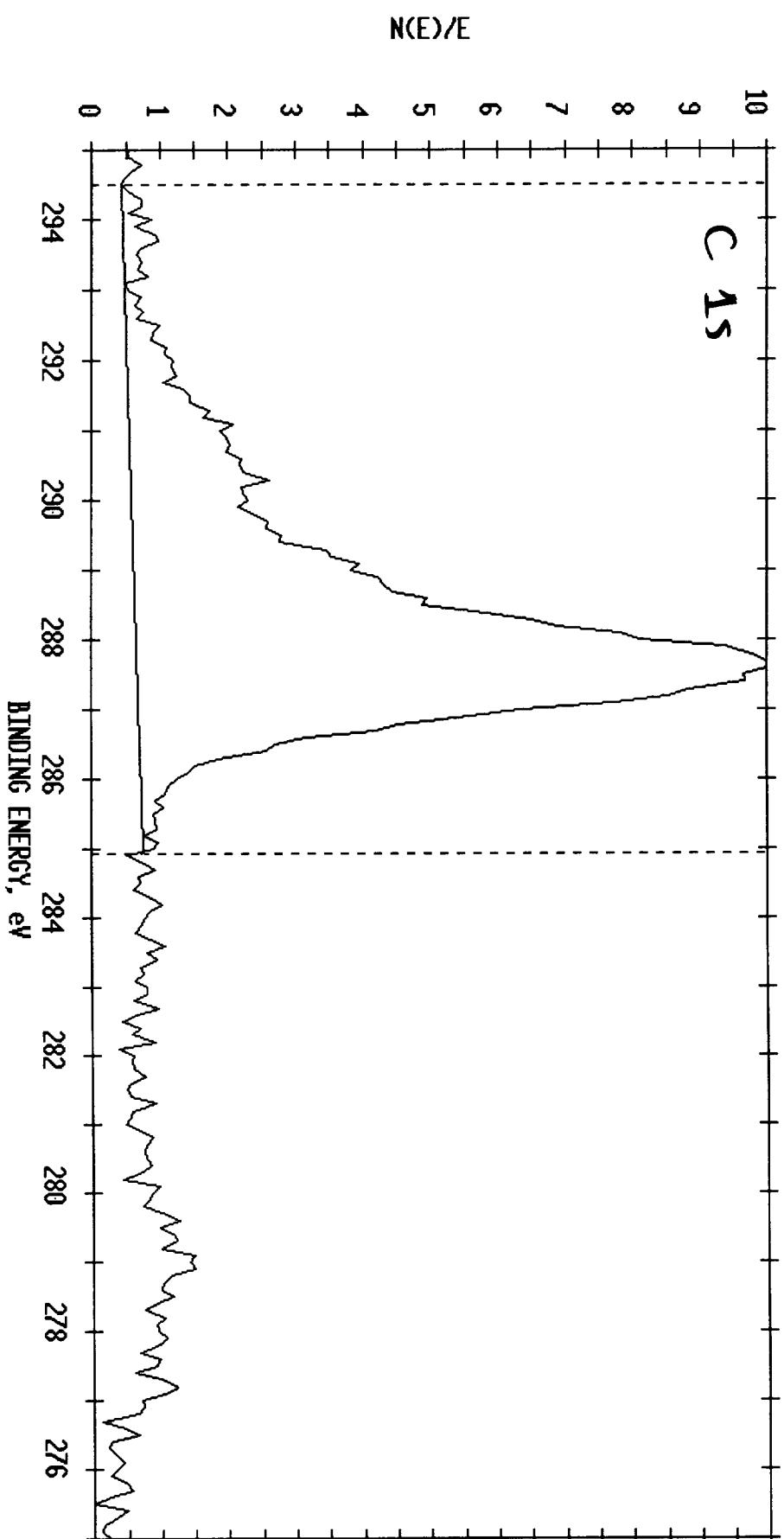
Acq complete Technique: ESCA
1/28/92 10:13

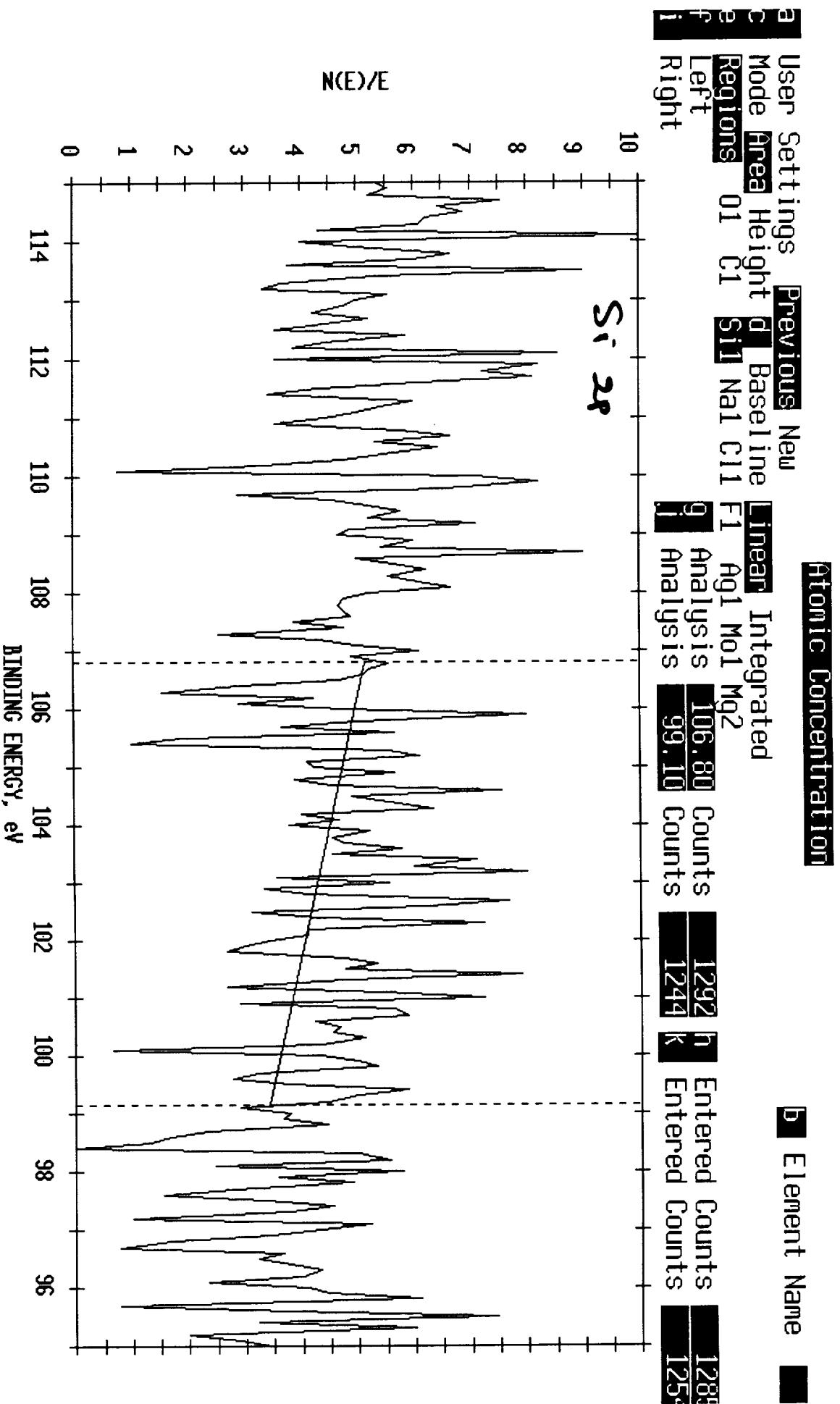


Atomic Concentration

b Element Name █

a User Settings Previous New
Mode Area Height Baseline Line Integrated
Regions 01 C1 Si1 Na1 Cl1 F1 Ag1 Mo1 Mg2
f Left g Analysis 294.50 Counts 3194 h Entered Counts 3194
i Right j Analysis 284.90 Counts 3222 k Entered Counts 3304

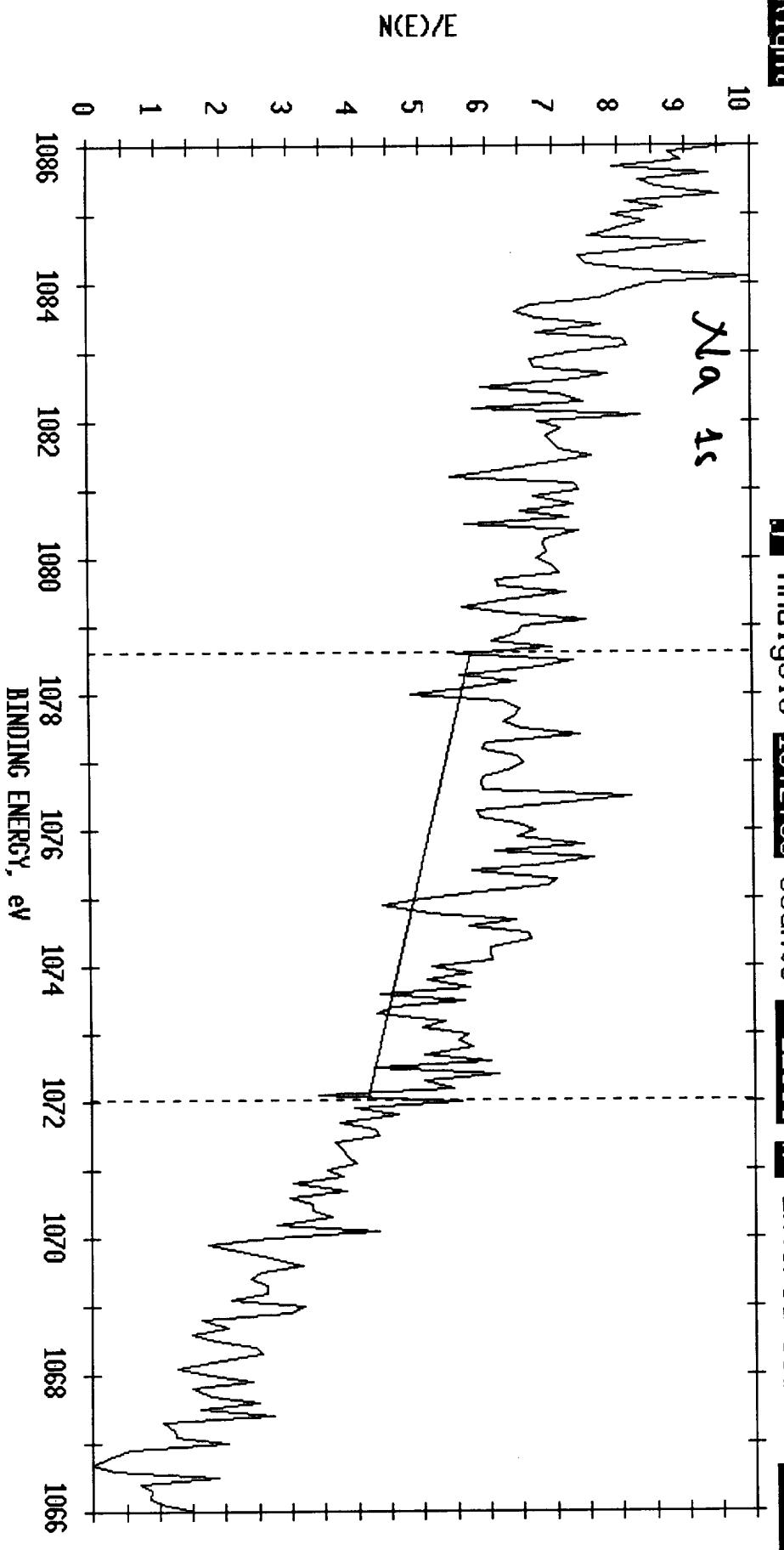




Atomic Concentration

b Element Name ■

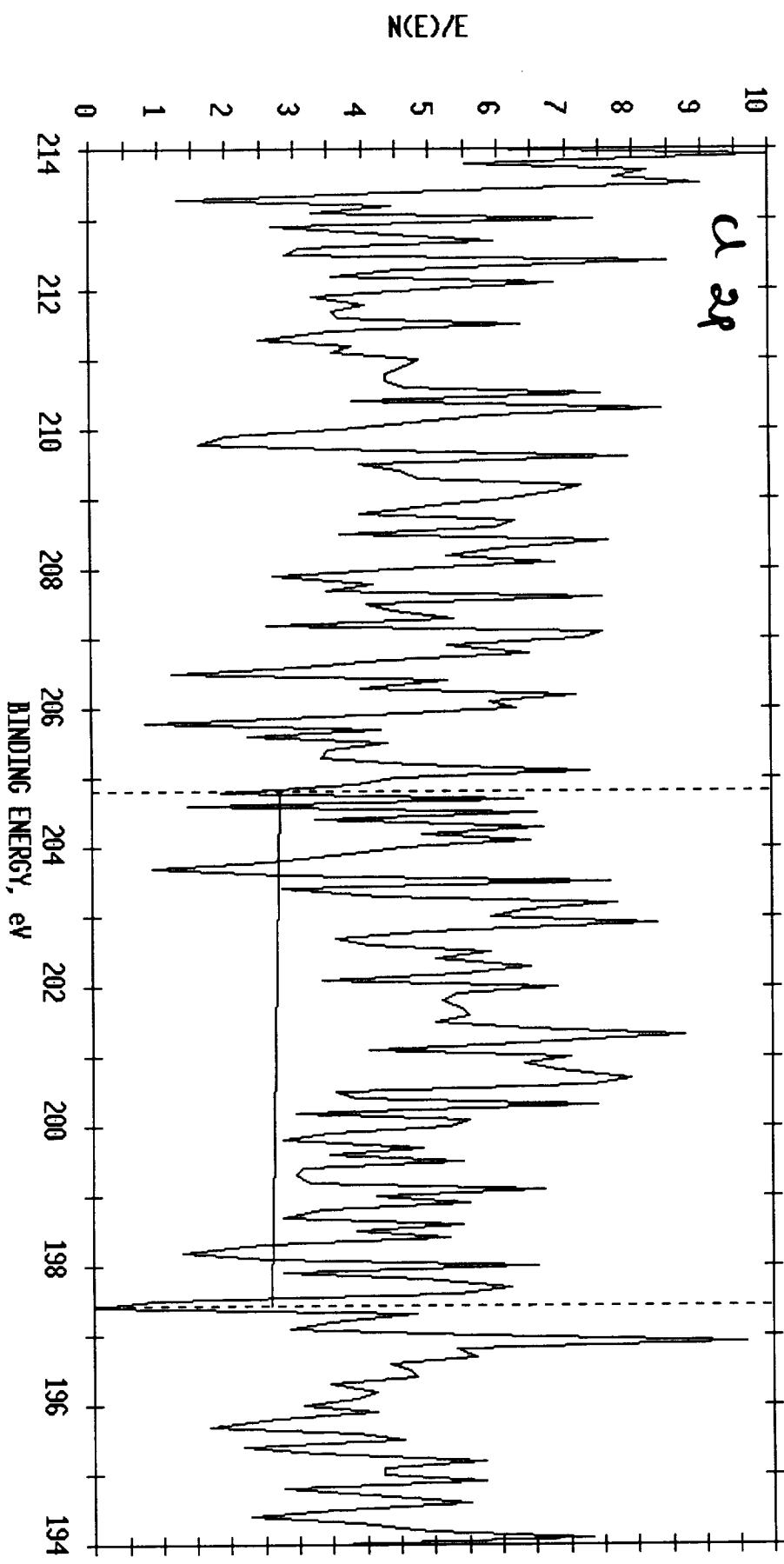
a	User Settings	Previous	New
c	Mode Area Height	d Baseline	Linear
e	Regions 01 C1	f Si1 Na1	C11 Ag1 Mo1 Mg2
f	Left	g Analysis	Counts 1078.60
i	Right	j Analysis	Counts 1072.00



Atomic Concentration

B Element Name

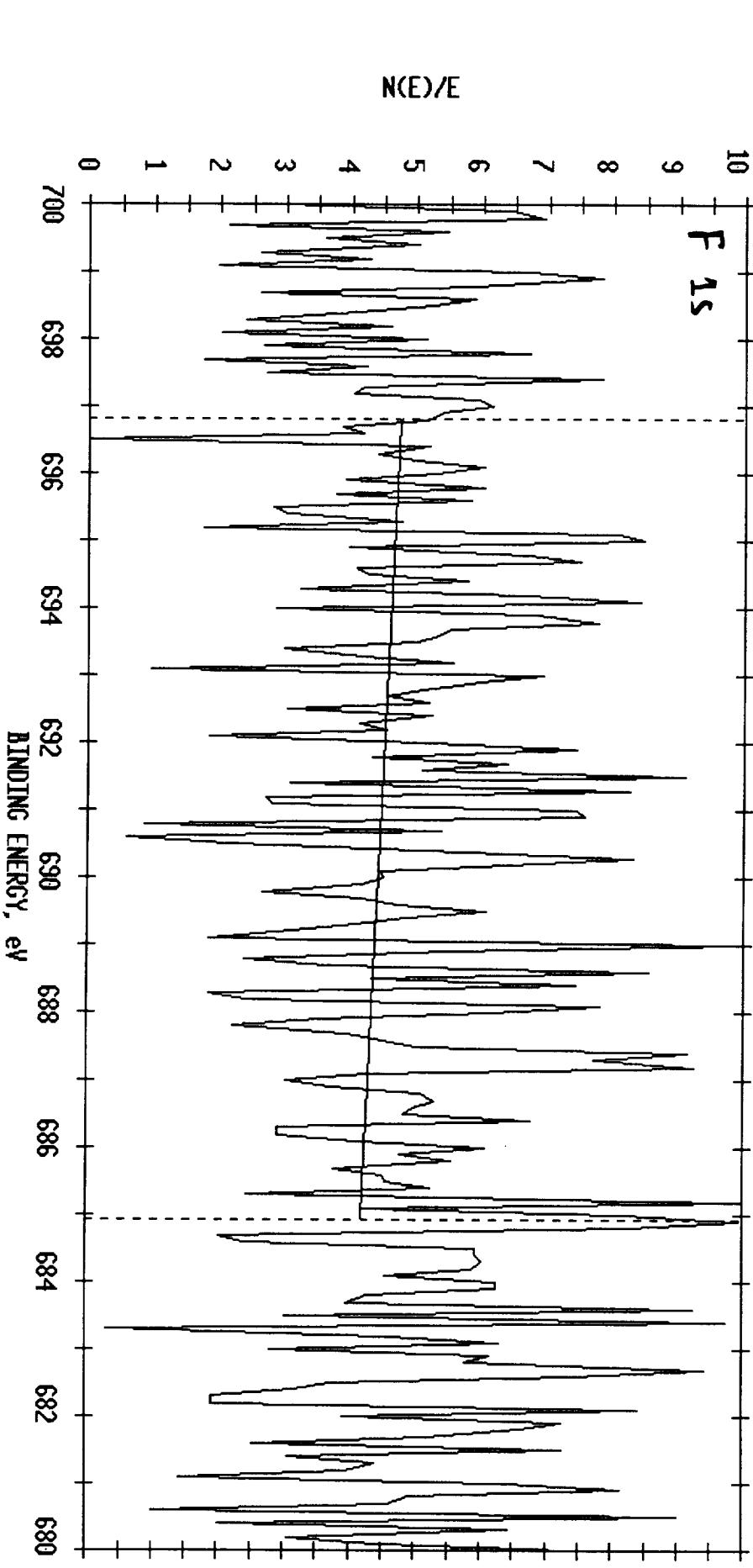
a	User Settings	Previous	New
c	Mode	Area	Baseline
e	Regions	01	C1
f	Left	Sil	Na1
i	Right	Cl1	Ag1
g	Analysis	Mg1	Mg2
j	Analysis	204.80	197.40
h	Entered Counts	1396	1414
k	Entered Counts	1358	141



Atomic Concentration

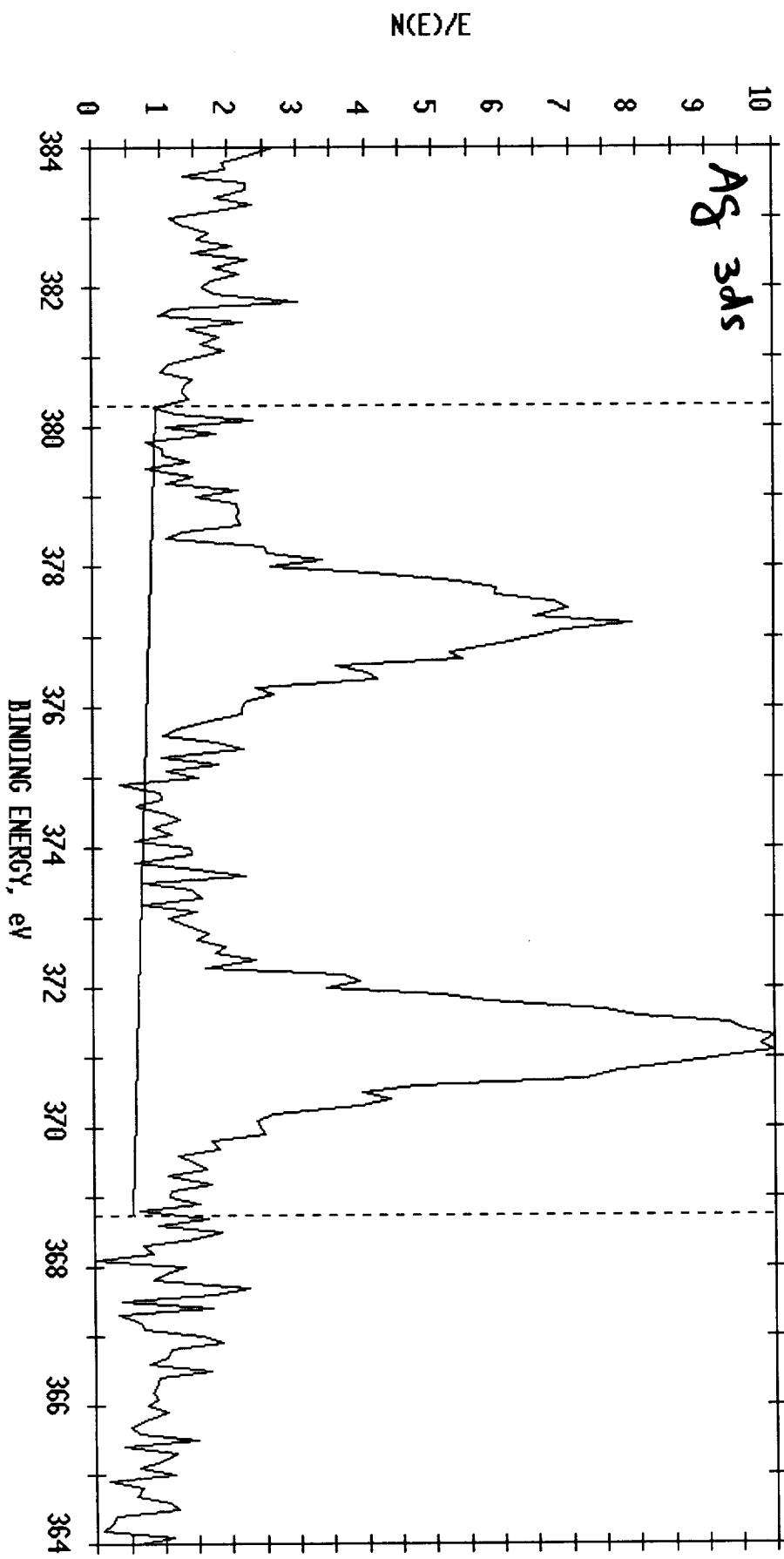
b Element Name

User Settings	Previous	New
Mode	Area	Height
Regions	01	C1
Left	Si1	Na1
Right	C11	
d Baseline	Linear	Integrated
E1 Ag1	Mg1	Mg2
g Analysis	696.80	Counts
i Analysis	684.90	Counts
	6140	h Entered Counts
	6322	k Entered Counts
	6120	
	6100	



Atomic Concentration

a	User Settings	Previous	New
c	Mode Area	Height	d Baseline
e	Regions	01 C1	Si1 Na1 C11
f	Left	F1 Ag1	Mg1 Mo1
i	Right	g Analysis	Mg2
		380.30 Counts	3442 h Entered Counts
		368.70 Counts	3542 k Entered Counts
			3440 l Entered Counts
			3396 m Entered Counts



b Element Name

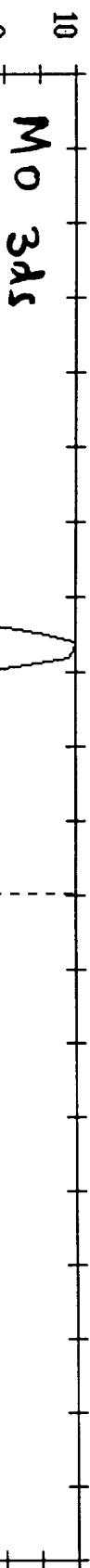
Atomic Concentration

b Element Name

a User Settings
c Previous
e Mode Area Height
f Regions 01 C1 Si1 Na1 Cl1
i Left Right

d Baseline
g Linear Integrated
h Analysis
j Analysis

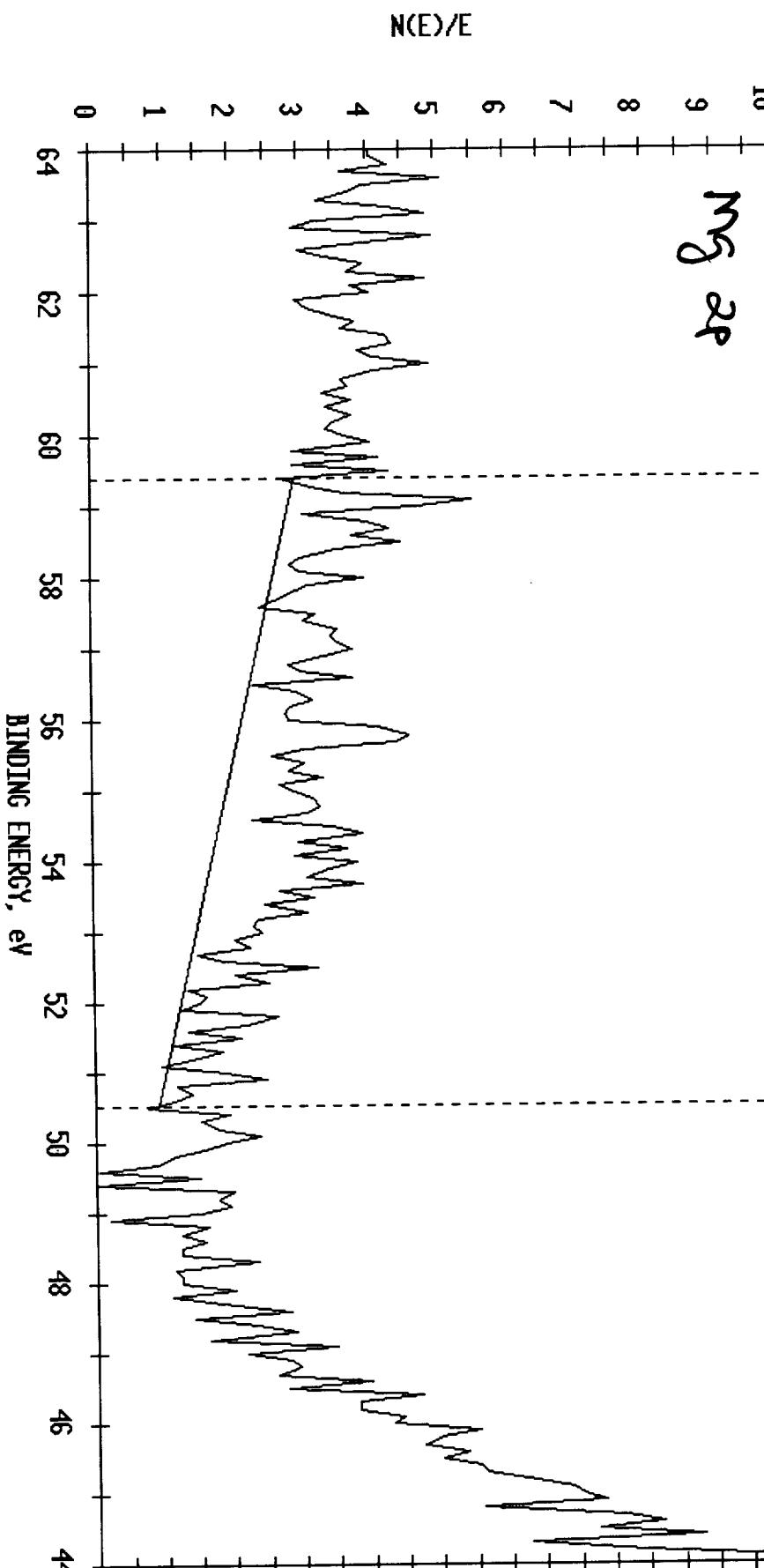
k Entered Counts
l Entered Counts
m Entered Counts
n Entered Counts
o Entered Counts
p Entered Counts
q Entered Counts
r Entered Counts
s Entered Counts
t Entered Counts
u Entered Counts
v Entered Counts
w Entered Counts
x Entered Counts
y Entered Counts
z Entered Counts



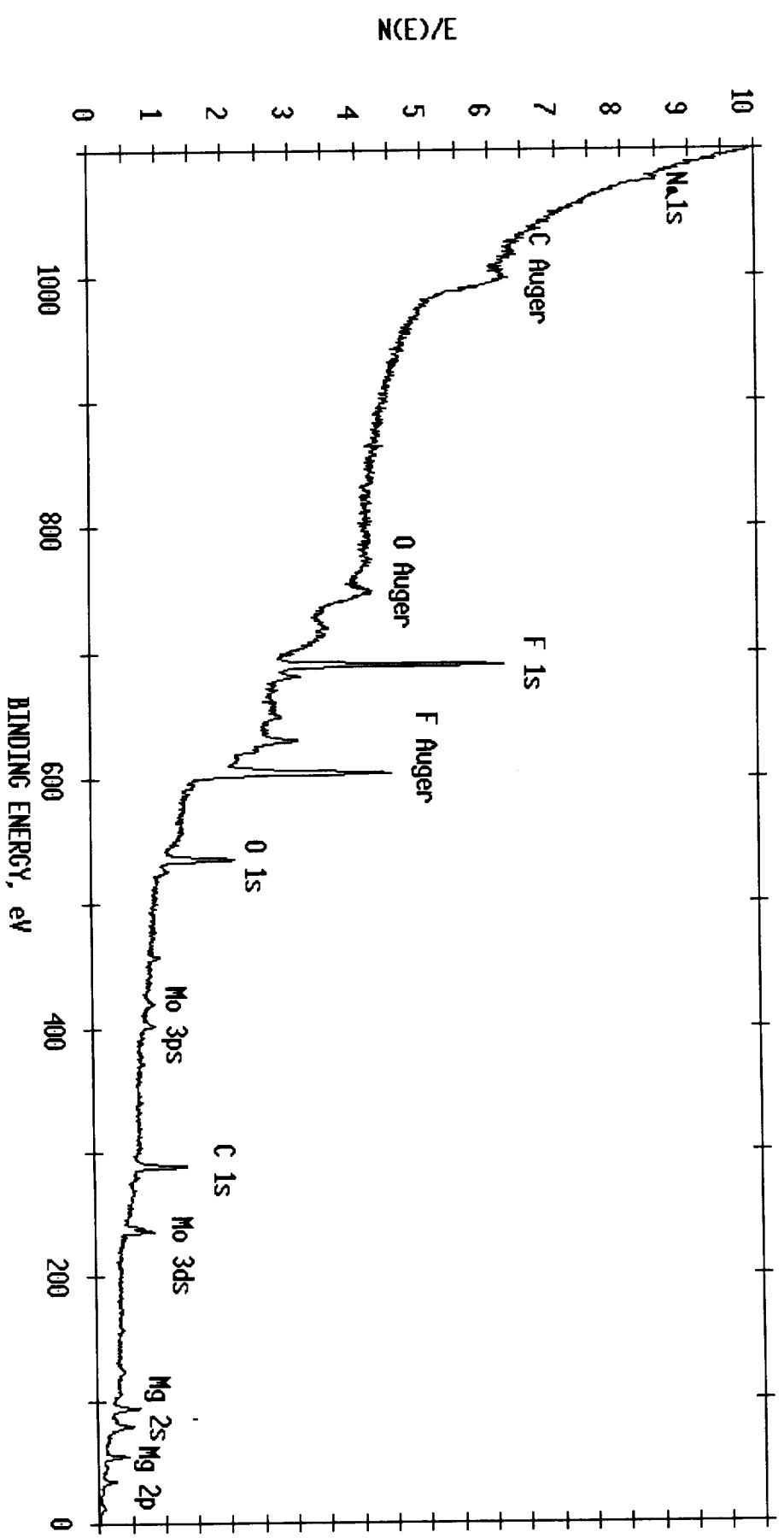
Atomic Concentration

b Element Name

a	User Settings	Previous	New
c	Mode	Height	Baseline
e	Regions	01	Linear
f	Left	C1	Integrated
i	Right	Si1	Line
d		Na1	
		C11	
		F1	
		Ag1	
		Mo1	
		Mg2	
g	Analysis	59.40	Counts
j	Analysis	50.50	Counts
h	Entered Counts	1094	
k	Entered Counts	1006	
		1104	
		1014	



ESCA SURVEY 1/27/92 ANGLE= 45 deg ACQ TIME=4.59 min
FILE: MgF₁_u_1 NASA, MgF₂ LDEF, Unexposed Region
SCALE FACTOR= 17.427 k c/s, OFFSET= 3.024 k c/s PASS ENERGY= 89.450 eV Mg 250 W



Print
AC Table AC Table

Exclude
Region
Atomic Concentration
Display Curve
More Softkeys
AC to AC Summary
Exit

a User Settings Previous New
c Mode Area Height d Baseline Lineare Integrated
e Regions 01 C1 Sil Nal C11 F1 Ag1 Mol Mg2

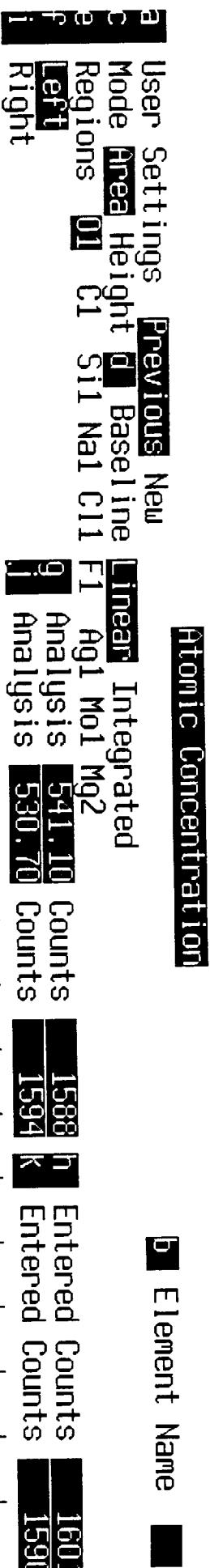
File: MgF1_u_2
Lens: Large Area Omni-Focus
Source: NASA, MgF2 LDEF, Unexposed Region

b Element Name
Element

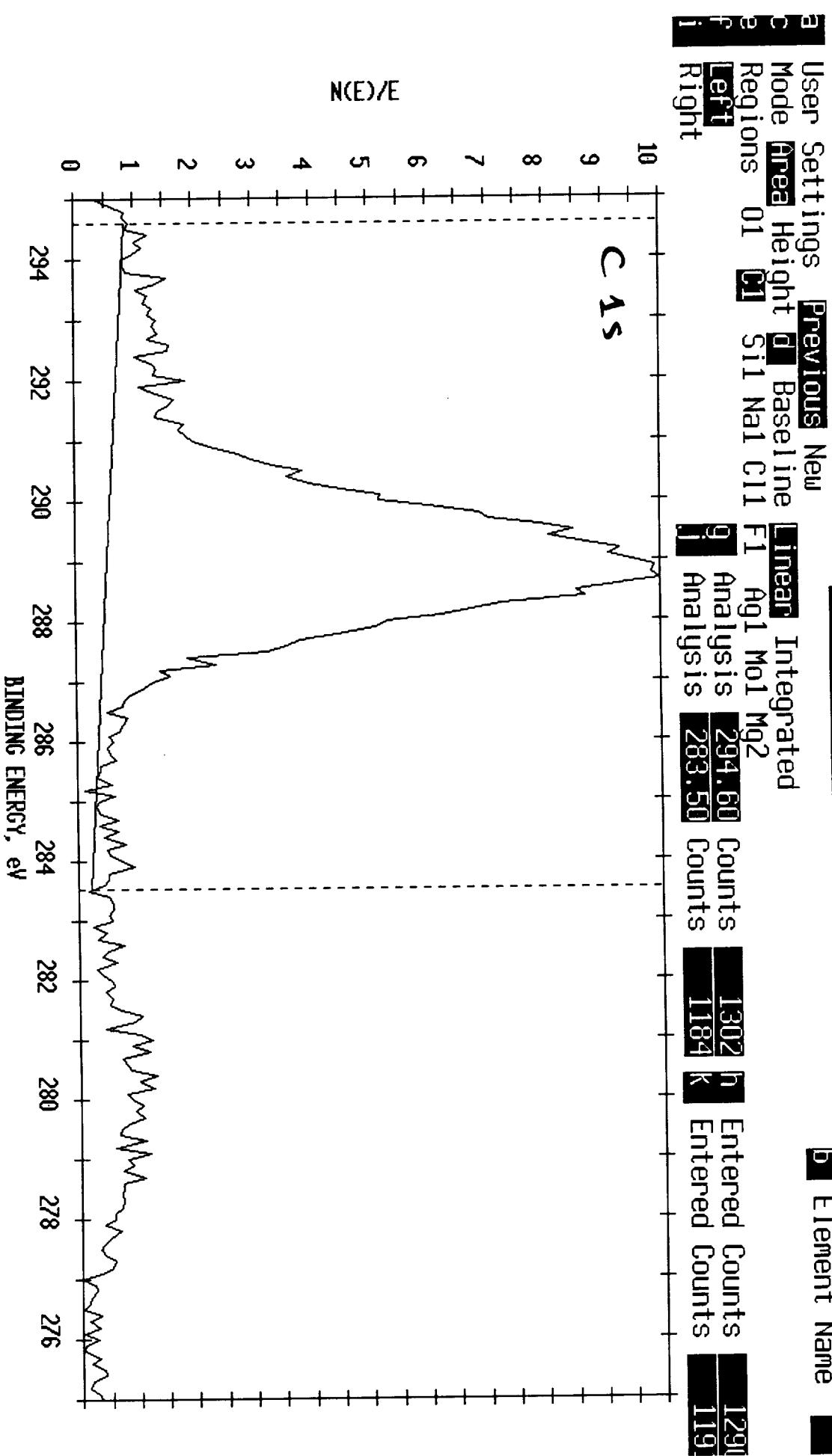
Element	Area (cts-eV/s)	Sensitivity Factor	Concentration (%)
O1s	10522	0.711	14.92
C1s	7266	0.296	24.75
Si2p	582	0.339	1.73
N1s	1478	1.685	0.88
C12p	708	0.891	0.80
F1s	33488	1.000	33.77
Ag3d	1766	5.987	0.30
Mo3d	3360	3.321	1.02
Mg2p	3310	0.153	21.82

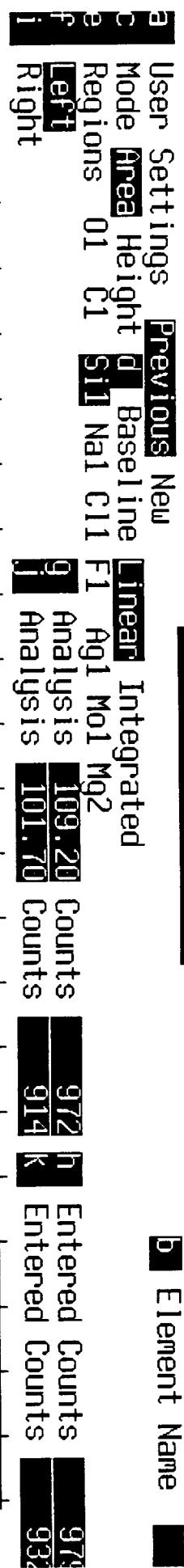
Ion Gun: OFF X-ray: OFF Mg
0.5mPa

Acq complete
Technique: ESCA
1/28/92 13:51



a Atomic Concentration



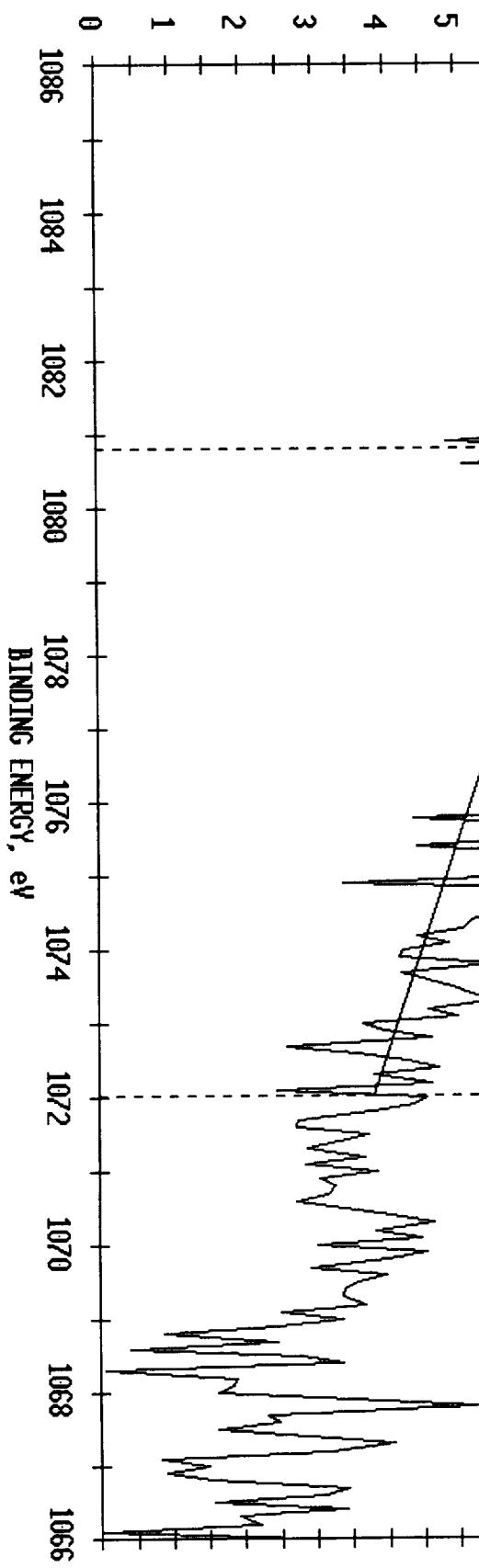


Atomic Concentration

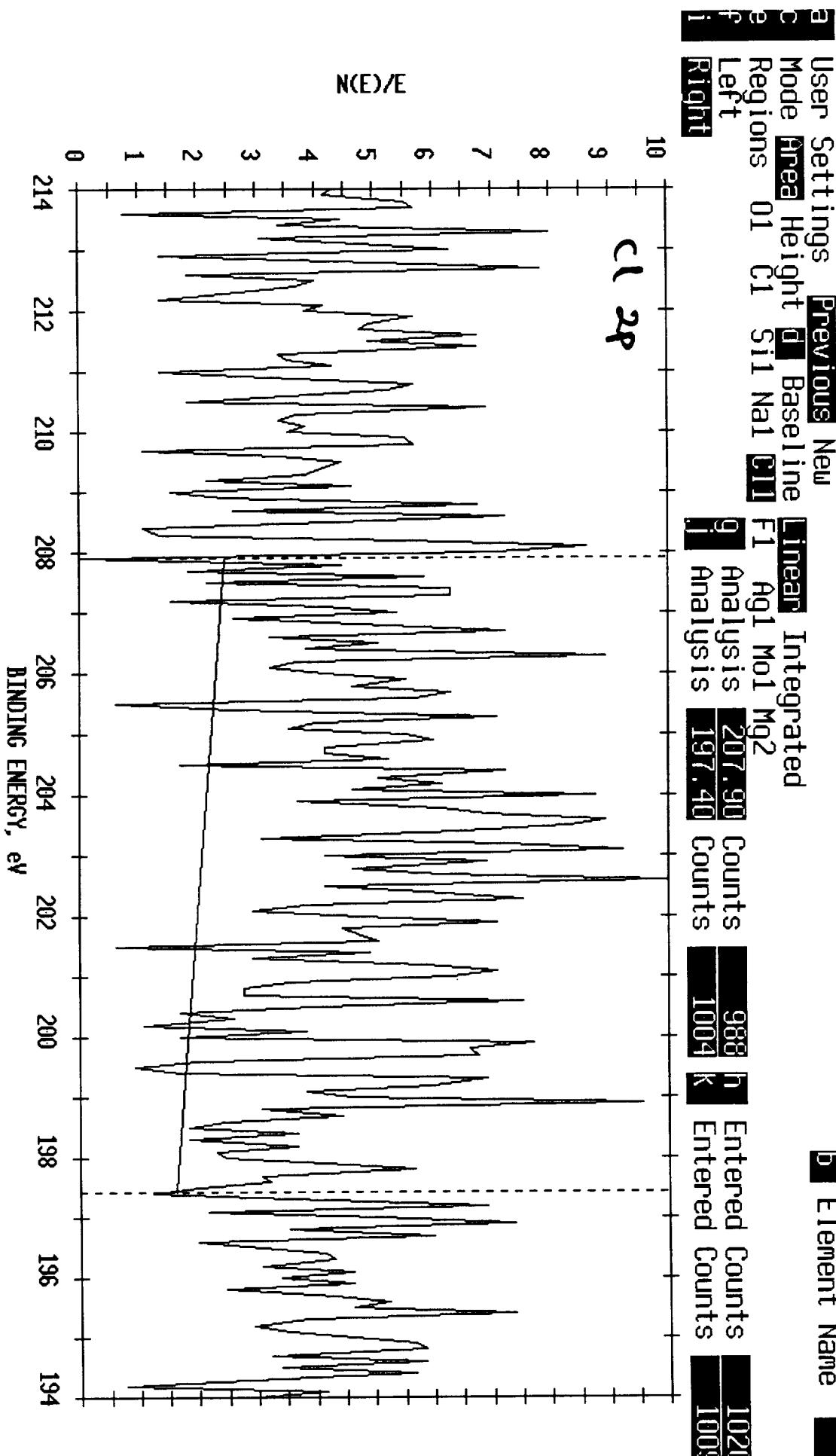
b Element Name ■

a User Settings	Previous	New
c Mode	d Baseline	Linear
e Regions	01 C1 Si1 Na1 Cl1 F1 Ag1 Mo1 Mg2	Counts
f Left	1080.80	Entered Counts
i Right	1072.00	Entered Counts
j Analysis	7510	7421
k Analysis	7226	7169

N(E)/E



Atomic Concentration

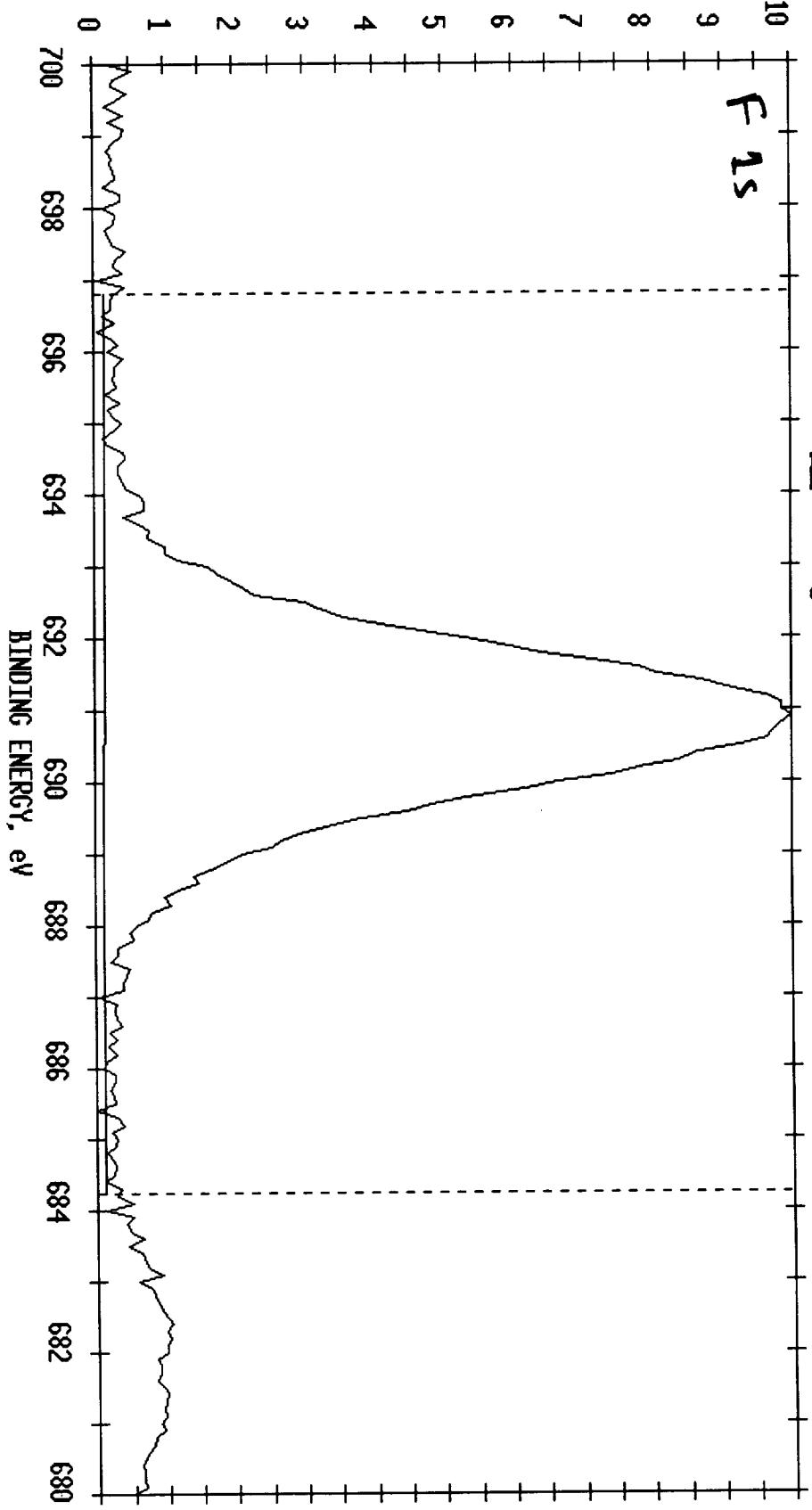


Atomic Concentration

b Element Name ■

User Settings	Previous	New
Mode	Baseline	Linear
Regions	01	C1
Left	C1	Si1
Right	Na1	Mg2
	F1	Ag1
	9	Mg1
	J	Analysis
	10	Counts
	8	696.80
	6	Counts
	4	3944
	2	3958
	0	k Entered Counts
	1	3861
	3	Entered Counts
	5	384
	7	
	9	
	10	

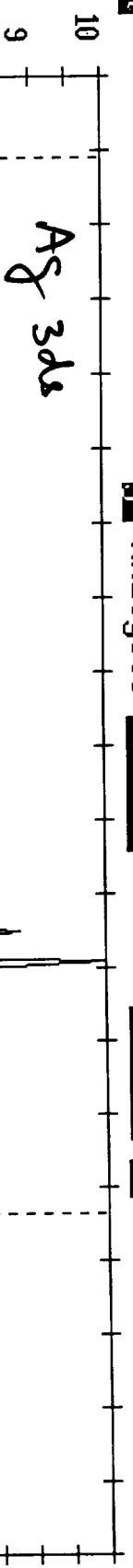
N(E)/E



Atomic Concentration

b Element Name ■

a	User Settings	Previous	New
c	Mode	Area	Height
e	Regions	01	C1
f	Left	Si1	Na1
i	Right	C11	Mg1
d	Baseline	Linear	Integrated
g	F1	Ag1	Mg2
j	Analysis	382.90	Counts
k	Analysis	368.60	Counts
h	Entered Counts	1256	h
l	Entered Counts	1276	k
m	Entered Counts	1264	l
n	Entered Counts	125	m

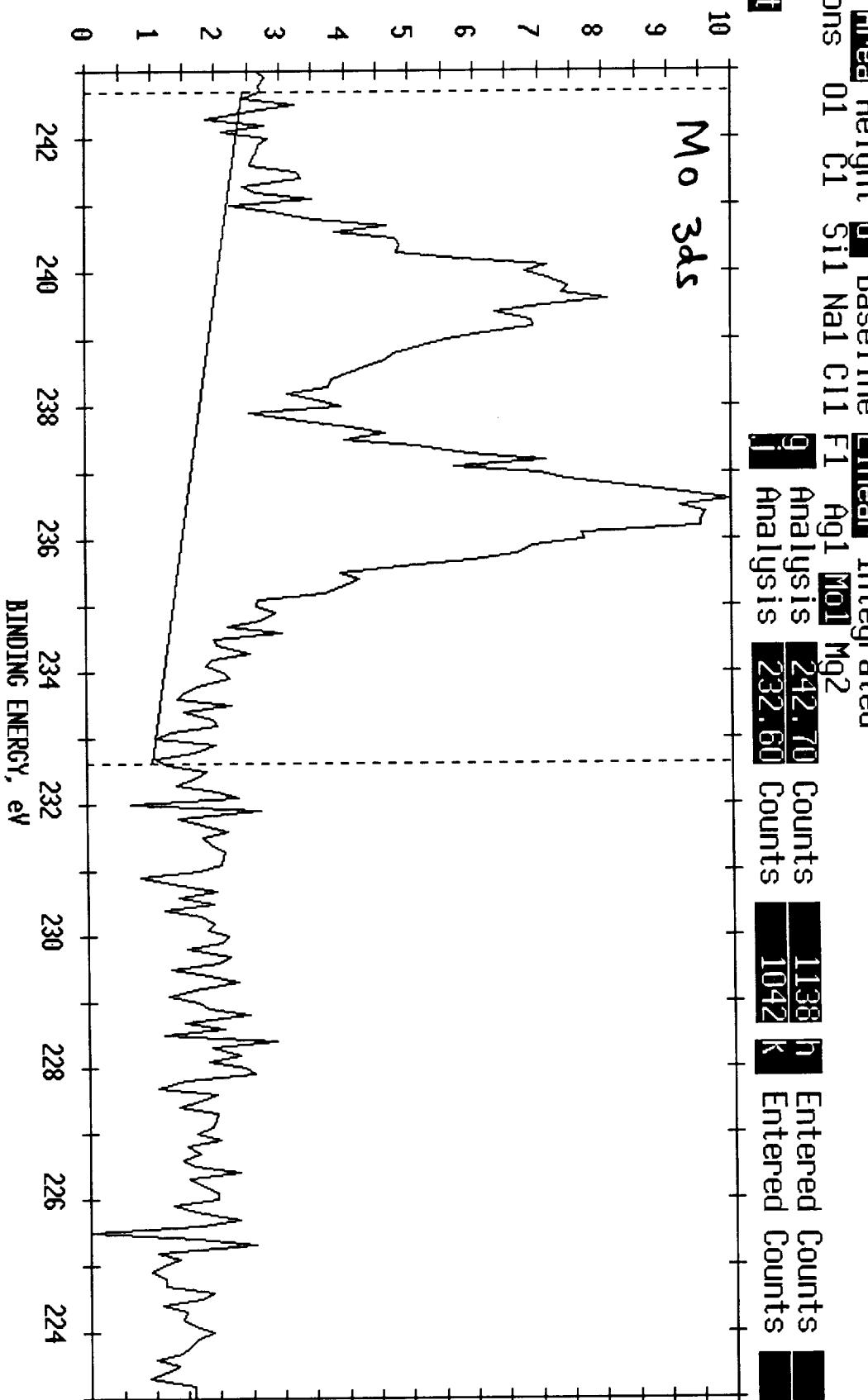


Atomic Concentration

a	User Settings	Previous	New	
c	Mode Area	Height	Baseline	
e	Regions	01 C1	Si1 Na1 C11	
f	Left	F1	Ag1	
i	Right	Mg1	Mg2	
9	Analysis	242.70	Counts	
j	Analysis	232.60	Counts	
h	Entered Counts	1138	Entered Counts	1121
k	Entered Counts	1042	Entered Counts	1024



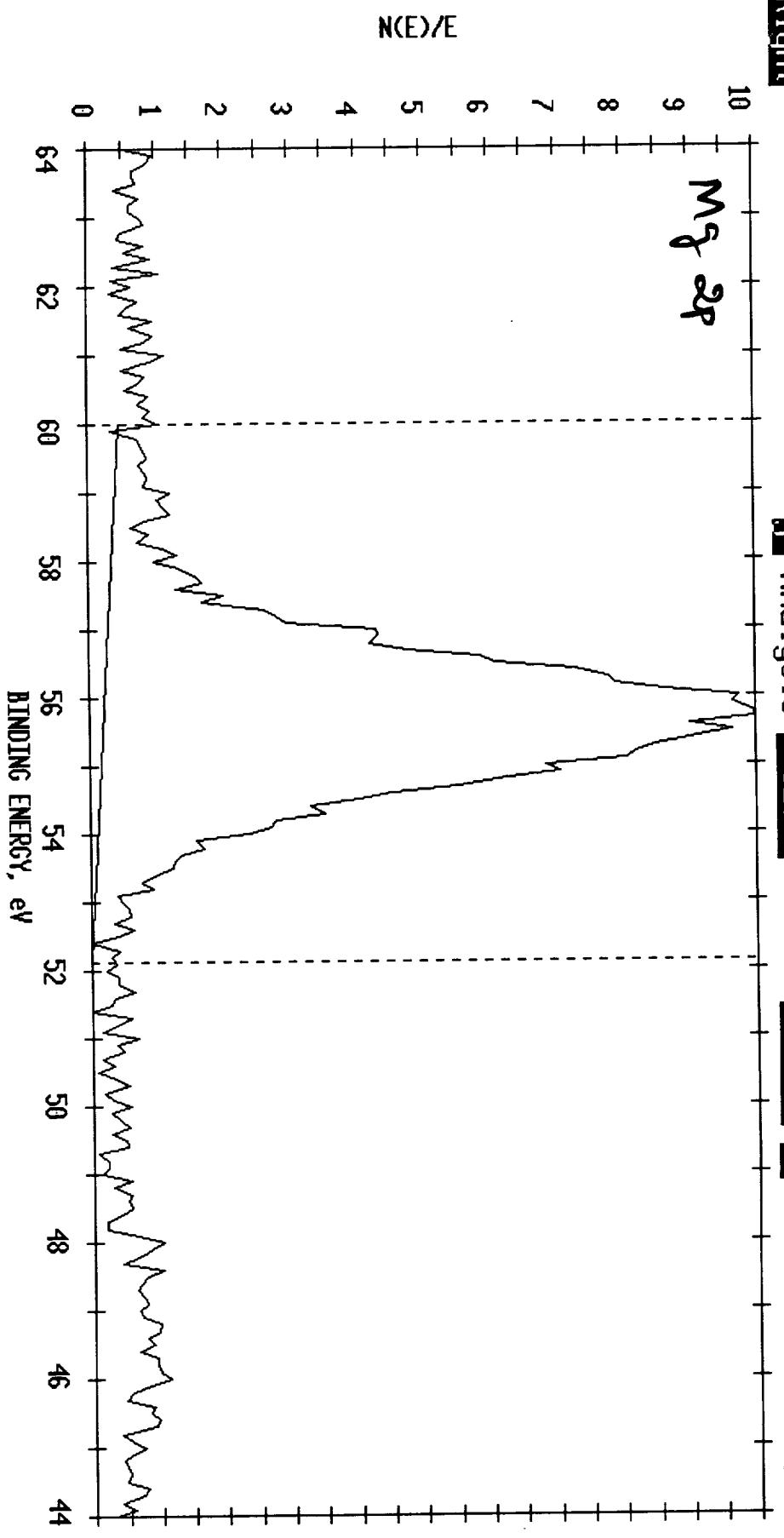
b Element Name



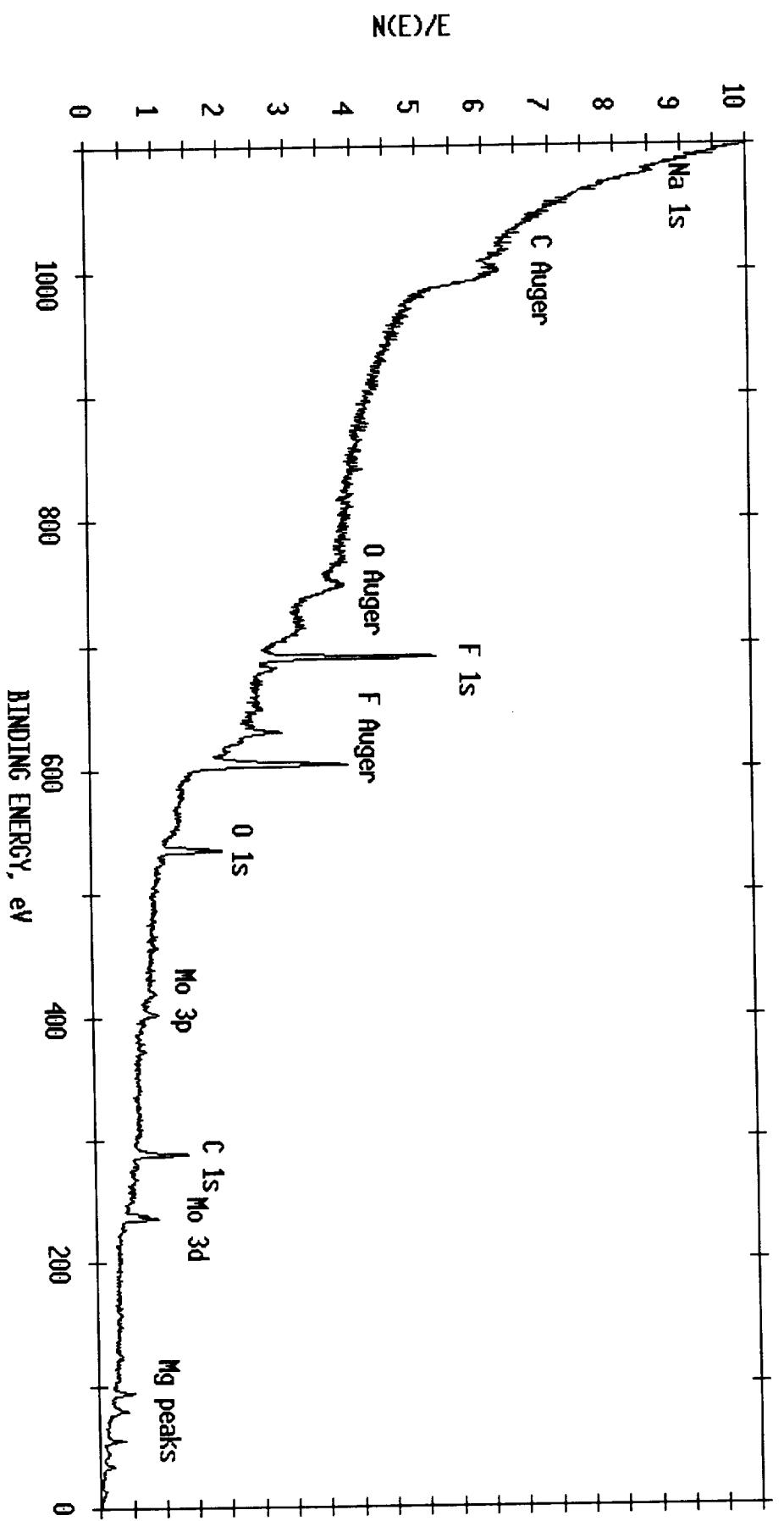
Atomic Concentration

b Element Name

a	User Settings	Previous	New
c	Mode Area	Height	Baseline
e	Regions	01 C1	Si1 Na1 C11
f	Left	F1	Ag1 Mo1
i	Right	Mg2	60.00
g		Counts	782
j		Entered Counts	740
k		Entered Counts	708
l			



ESCA SURVEY 1/28/92 ANGLE= 45 deg ACQ TIME=3.67 min
FILE: MgF₁_u_4 NASA, MgF₂, LDEF, Unexposed Region 2
SCALE FACTOR= 15.618 k c/s, OFFSET= 2.820 k c/s PASS ENERGY= 89.450 eV Mg 250 W



Print
AC Table AC Table

Exclude
Region
Atomic Concentration

Display Curve
More Softkeys
AC to AC Summary
Exit

b Element Name

a User Settings Previous New
c Mode Area Height d Baseline Lineare Integrated
e Regions O1 C1 Si1 Na1 Cl1 F1 Ag1 Mo1 Mg2

File: MgF1_u_5
Lens: Large Area Omni-Focus
NASA, MgF2, LDEF, Unexposed REGION 2
Source: Standard

Element	Area (cts-eV/s)	Sensitivity Factor	Concentration (%)
O1s	7996	0.711	13.95
C1s	7246	0.296	30.36
Si2p	582	0.339	2.13
Na1s	708	1.685	0.52
Cl2p	532	0.891	0.74
F1s	24724	1.000	30.66
Ag3d	2190	5.987	0.45
Mo3d	5136	3.321	1.92
Mg2p	2378	0.153	19.27

Ion Gun: OFF
0.5mPa

X-ray: OFF Mg

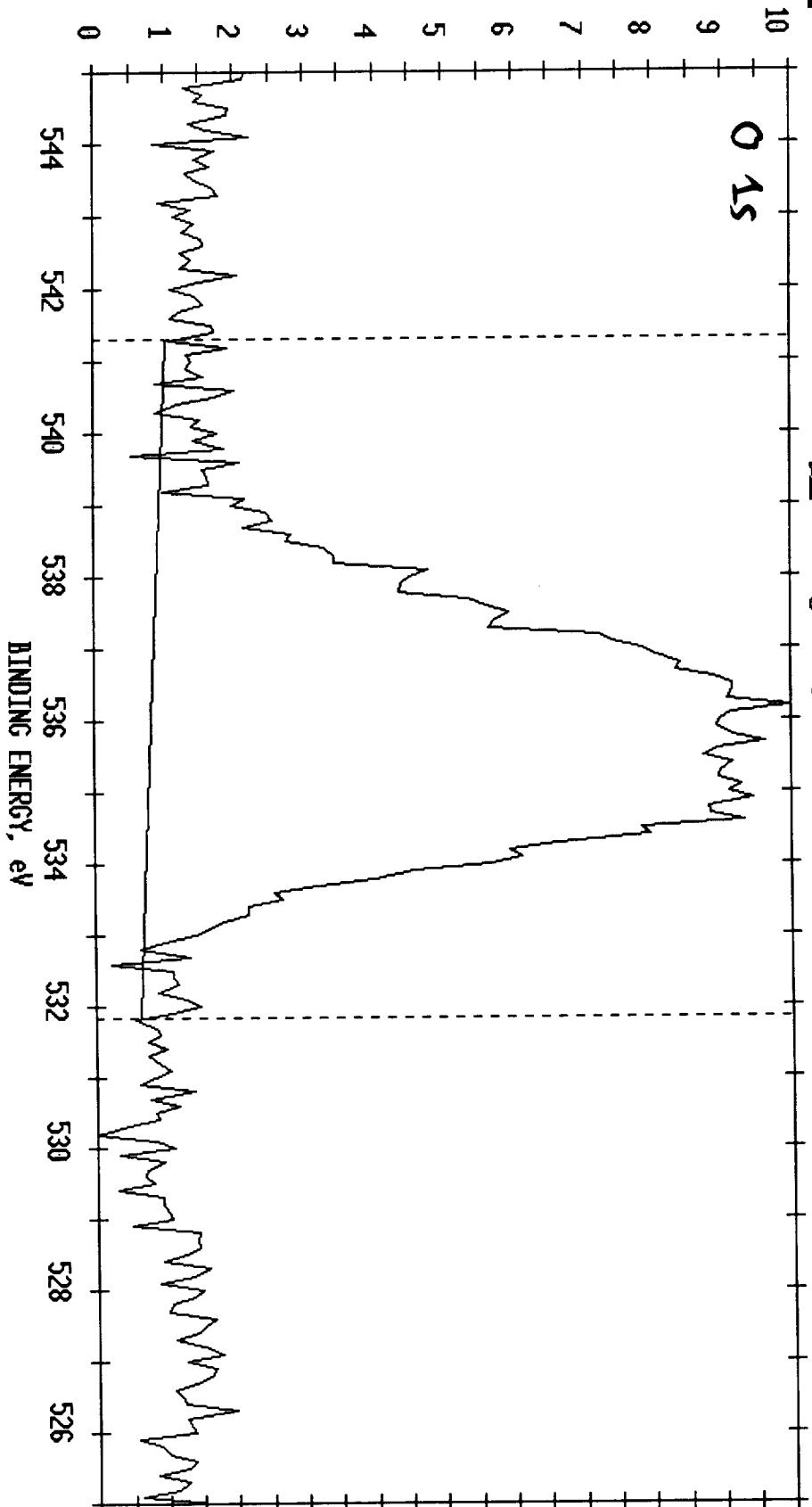
Technique: ESCA
1/28/92 14:40

Atomic Concentration

b Element Name

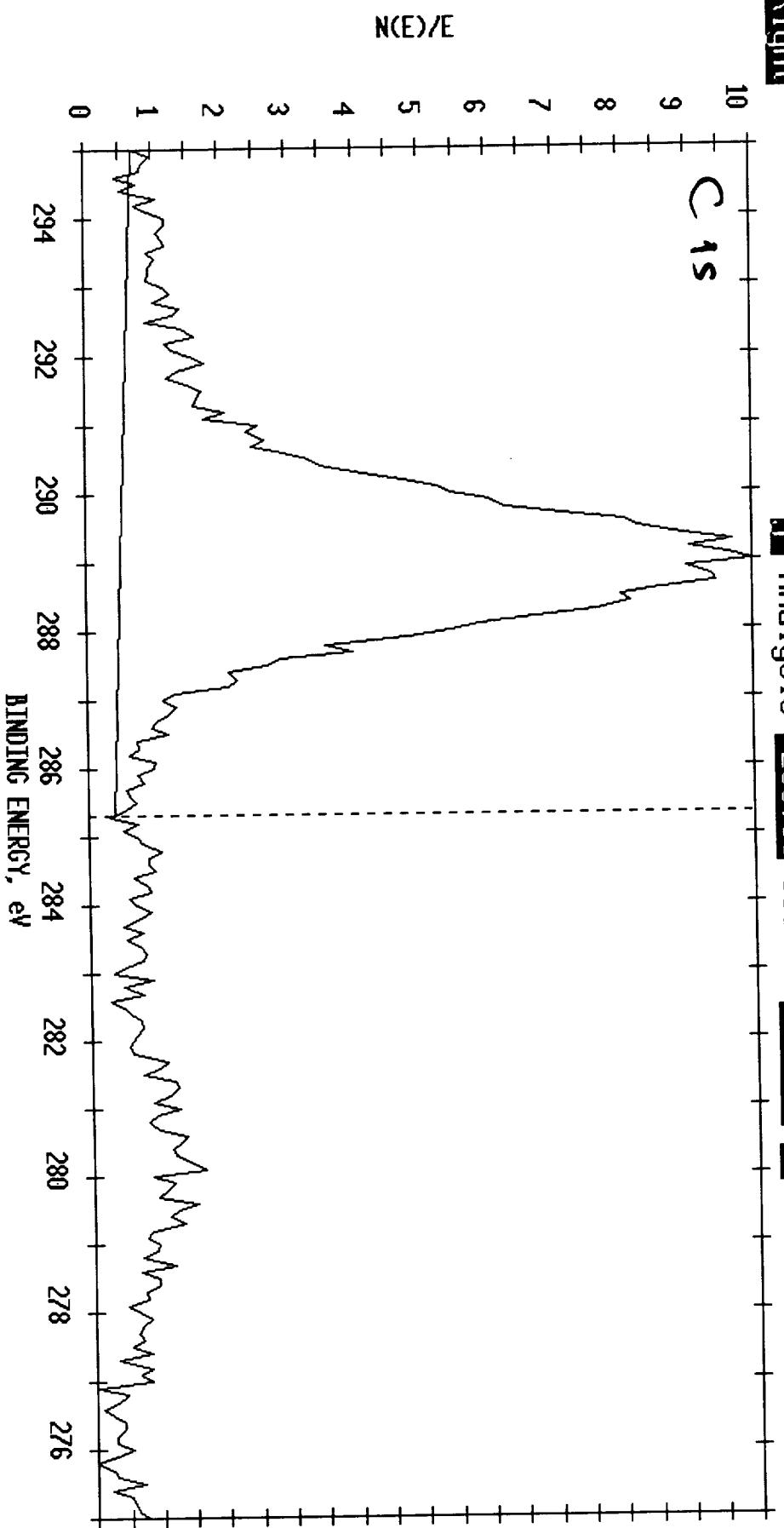
User Settings	Previous	New
Mode	Area	Height
Regions	01	C1
Left	Si1	Na1
Right	C11	F1
	Ag1	Mg1
	Mg2	
g Analysis	541.30	Counts
j Analysis	531.80	Counts
h Entered Counts	1660	Entered Counts
k Entered Counts	1600	Entered Counts

N(E)/E



Atomic Concentration

a	User Settings	Previous	New
c	Mode Area	Height	Baseline
e	Regions	01	Linear
f	Left	C1	Integrated
i	Right	Si1 Na1 C11	
9		F1 Ag1 Mo1 Mg2	
j		Analysis	
l		295.00	Counts
m		285.30	Counts
n		1224	Entered Counts
o		1164	k Entered Counts
p		1224	Entered Counts
q		1170	Entered Counts

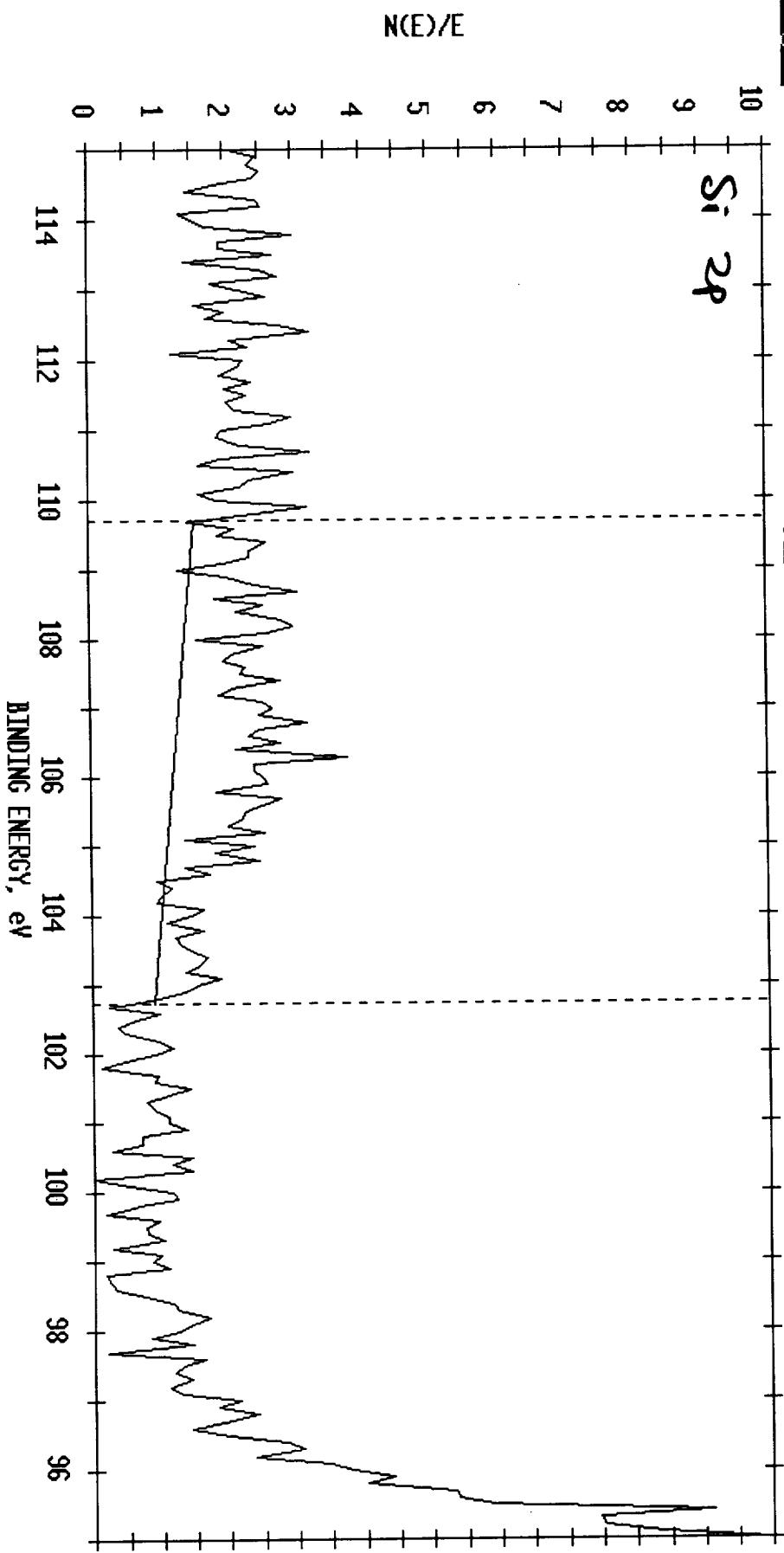


b Element Name

Atomic Concentration

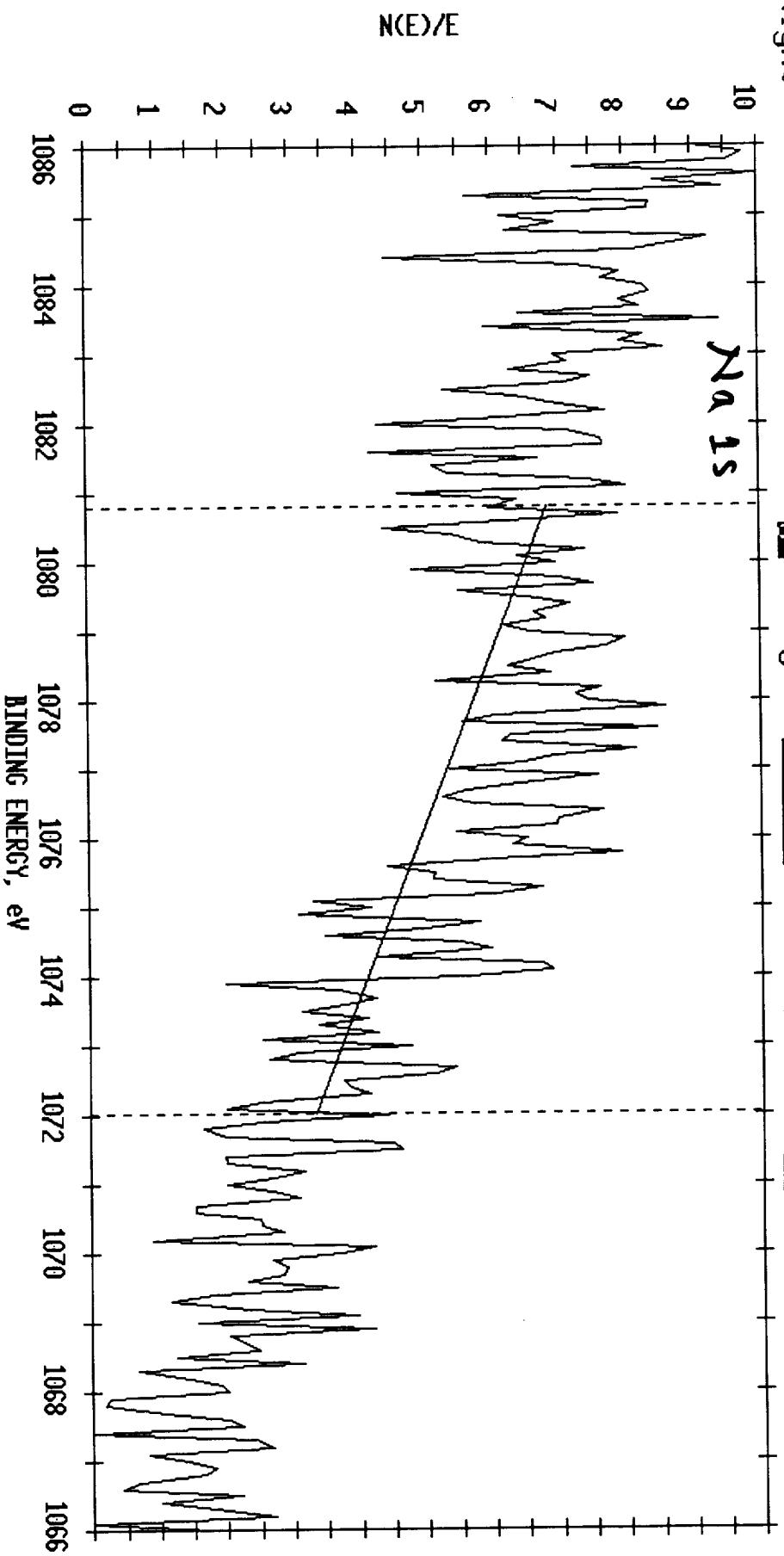
b Element Name ■

a User Settings	Previous	New
c Mode Area	Height	Baseline
e Regions	01 C1	Si1 Na1 C11 F1 Ag1 Mo1 Mg2
f Left	9 Analysis	109.70 Counts
i Right	j Analysis	102.70 Counts
	k Entered Counts	913
	l Entered Counts	881



Atomic Concentration

a	User Settings	Previous	New
c	Mode	Height	d Baseline
e	Regions	01 C1 Si1 Na1 Cl1 F1 Ag1 Mo1 Mg2	Linear
f	Left	Counts	Entered Counts
i	Right	6612 h	6674
j	Analysis	Counts	Entered Counts
g	Analysis	6504	6424
k	1080.80	1072.00	

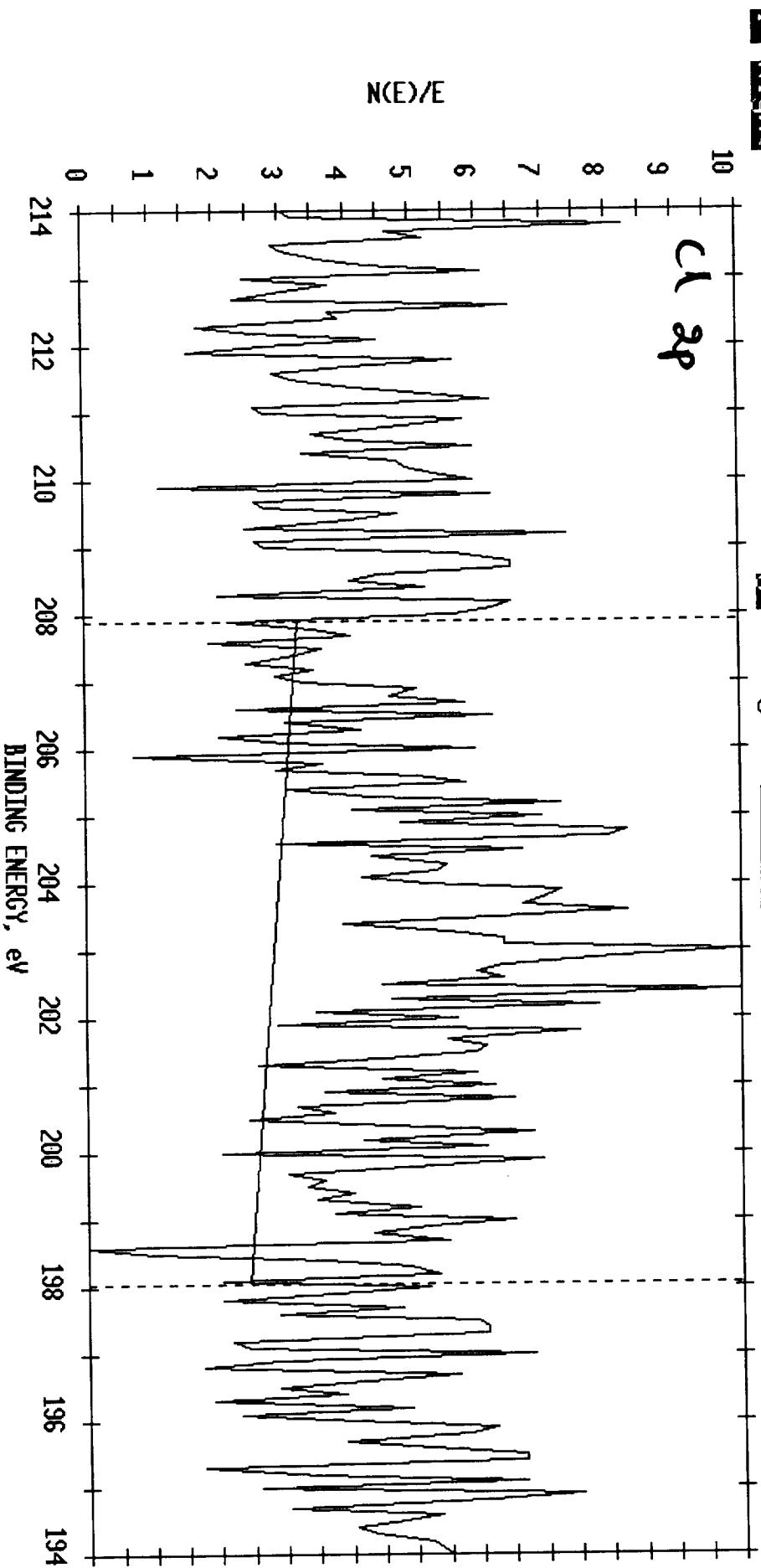


b Element Name

Atomic Concentration

b Element Name

a	User Settings	Previous	New
c	Mode Area	Height	Baseline
e	Regions	01 C1	Si1 Na1 CII
f	Left	9	Analysis
i	Right	198.00	Analysis
j		942	Entered Counts
k		984	Entered Counts

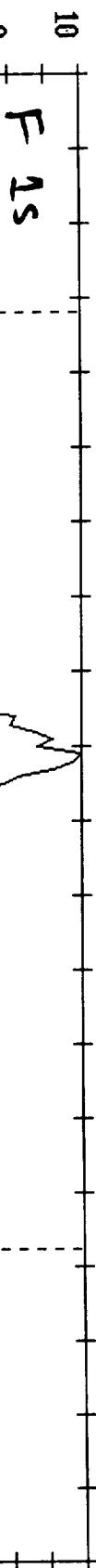


Atomic Concentration

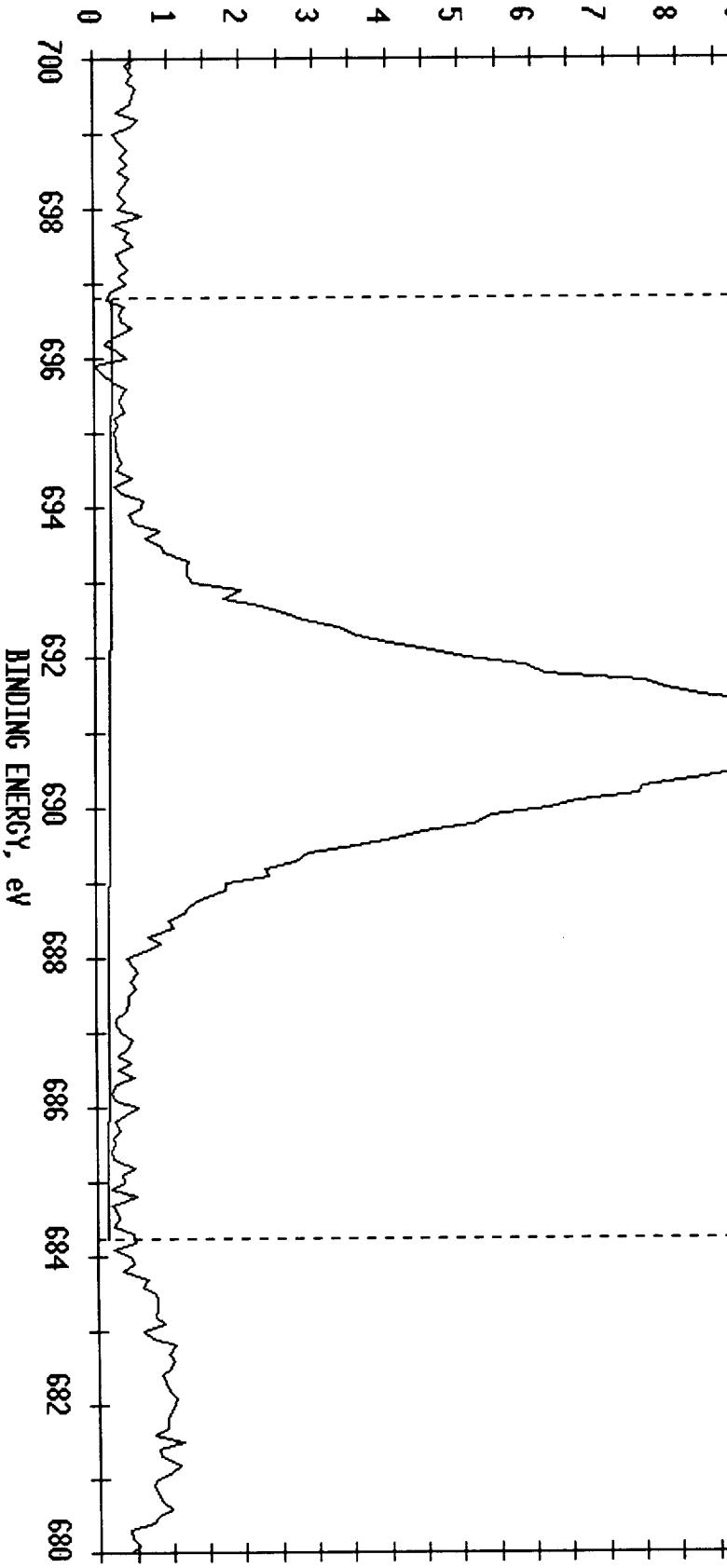
b Element Name

a User Settings	Previous	New
c Mode	Height	d Baseline
e Regions	01 C1	Si1 Na1 Cl1
f Left	Ag1 Mo1 Mg2	
i Right	F1	
	g Analysis	
	j Analysis	
	h Entered Counts	3473
	i Entered Counts	3420
	j Entered Counts	3614
	k Entered Counts	3446

N(E)/E



F 1s



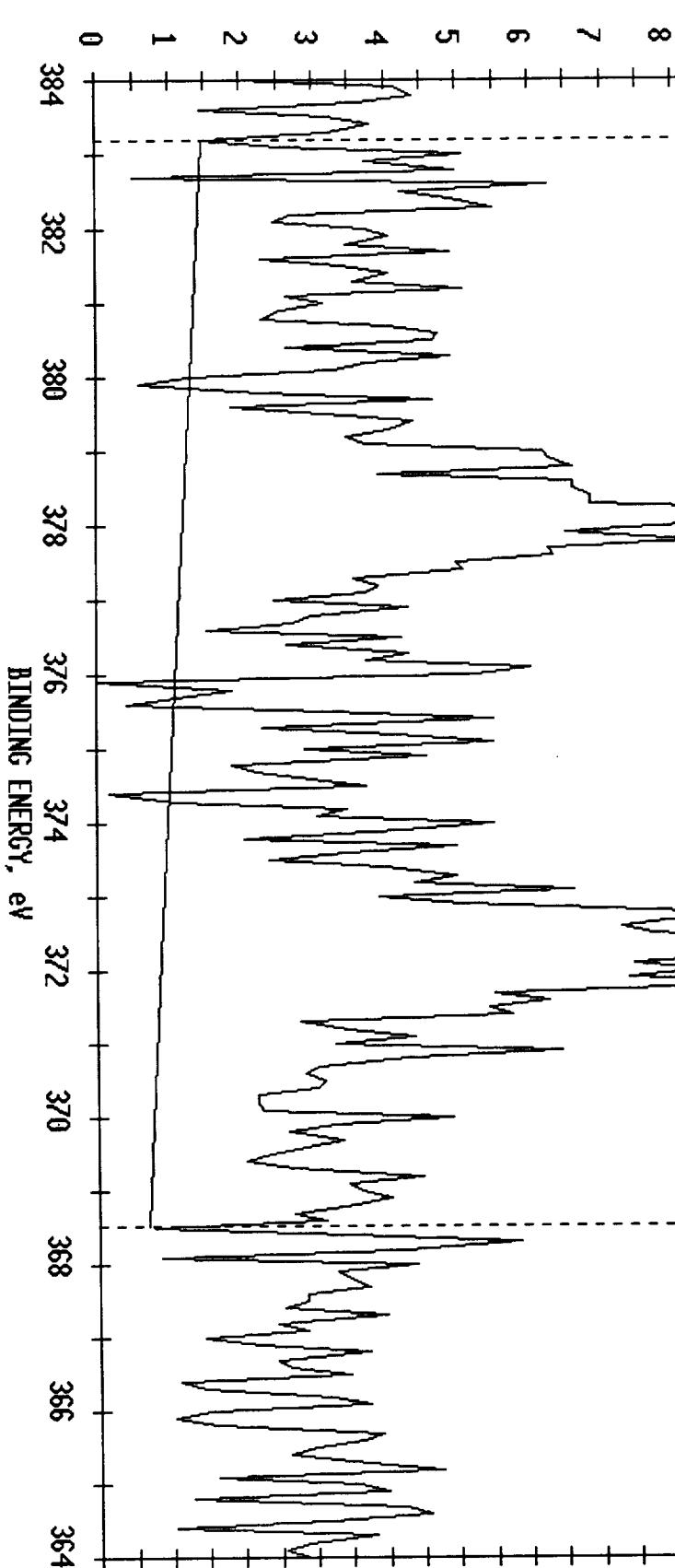
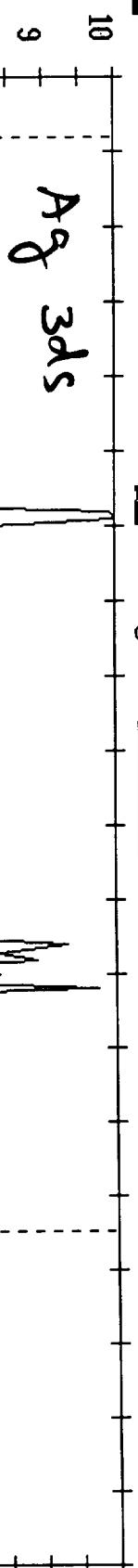
N(E)/E

C 1s

Atomic Concentration

b Element Name ■

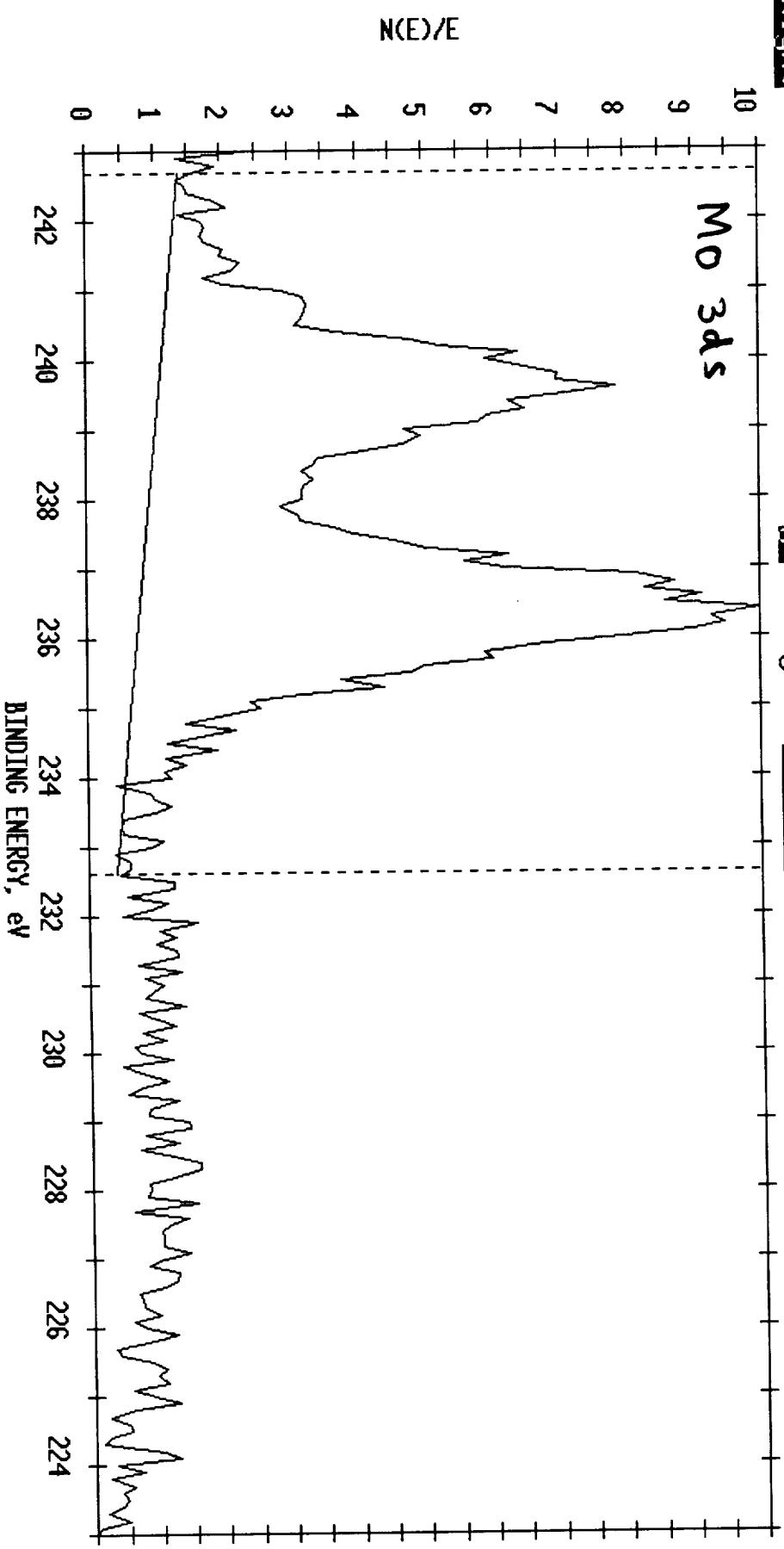
a User Settings Previous New
Mode Area Height d Baseline Line Integrated
e Regions 01 C1 Si1 Na1 C11 F1 Mg1 Mo1 Mg2
f Left Right g Analysis 383.20 Counts 1254 h Entered Counts 1258
i Right j Analysis 368.50 Counts 1238 k Entered Counts 1230

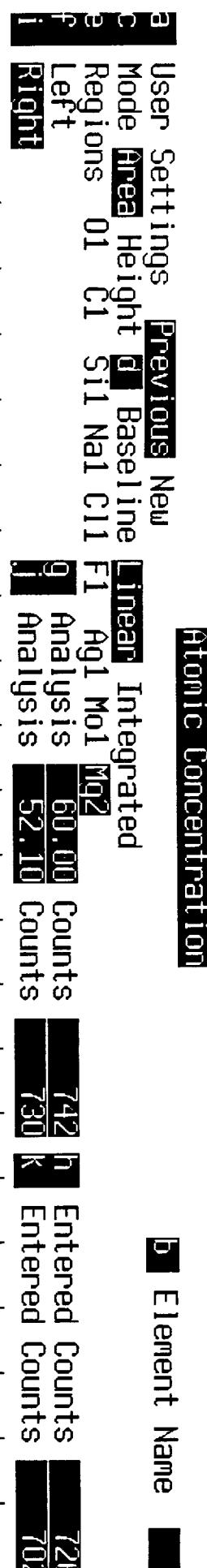


Atomic Concentration

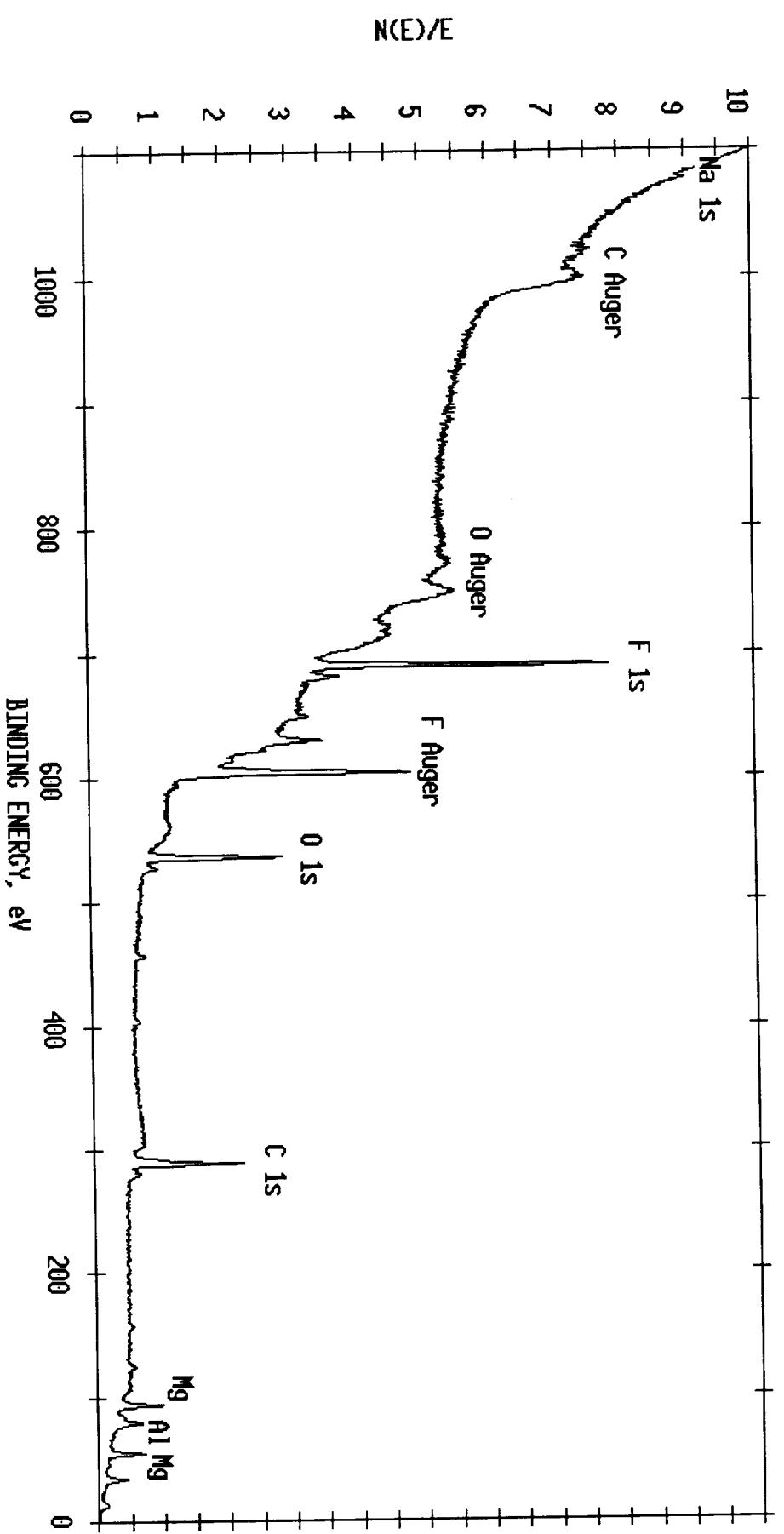
b Element Name ■

a	User Settings	Previous	New
c	Mode	Height	d Baseline
e	Regions	01	C1 Si1 Na1 C11 F1 Ag1 Mo1 Mg2
f	Left		
i	Right		
j	Analysis	242.70	Counts
g	Analysis	232.60	Counts
h	Entered Counts	1086	
k	Entered Counts	986	





ESCA SURVEY 1/24/92 ANGLE= 45 deg ACQ TIME=4.59 min
FILE: MgF₂_1 NASA, MgF₂ Control sample
SCALE FACTOR= 30.597 k c/s, OFFSET= 3.200 k c/s PASS ENERGY= 89.450 eV Mg 250 μ



Print AC Table Exit
 AC Table Exclude
 a User Settings Region
 c Mode Area Height d Baseline Display
 e Regions Linear More
 o1 Integrated AC to AC
 c1 NL Softkeys
 si1 f1 Summary
 na1 mg1 b Element Name
 cl1 al1 mg2

File: MgF2_2
 Lens: Large Area Omni-Focus
 NASA, MgF2 Control sample
 Source: Standard

Atomic Concentration Table

Element	Area (cts-eV/s)	Sensitivity Factor	Concentration (%)
O1s	24176	0.711	12.74
C1s	23560	0.296	29.83
Si2p	1176	0.339	1.30
Na1s	2698	1.685	0.60
Cl2p	746	0.891	0.31
N1s	1342	0.477	1.05
F1s	64512	1.000	24.17
Al2p	6150	0.234	9.85
Mg2p	8224	0.153	20.14

Ion Gun: OFF X-ray: OFF Mg
 0.5mPa

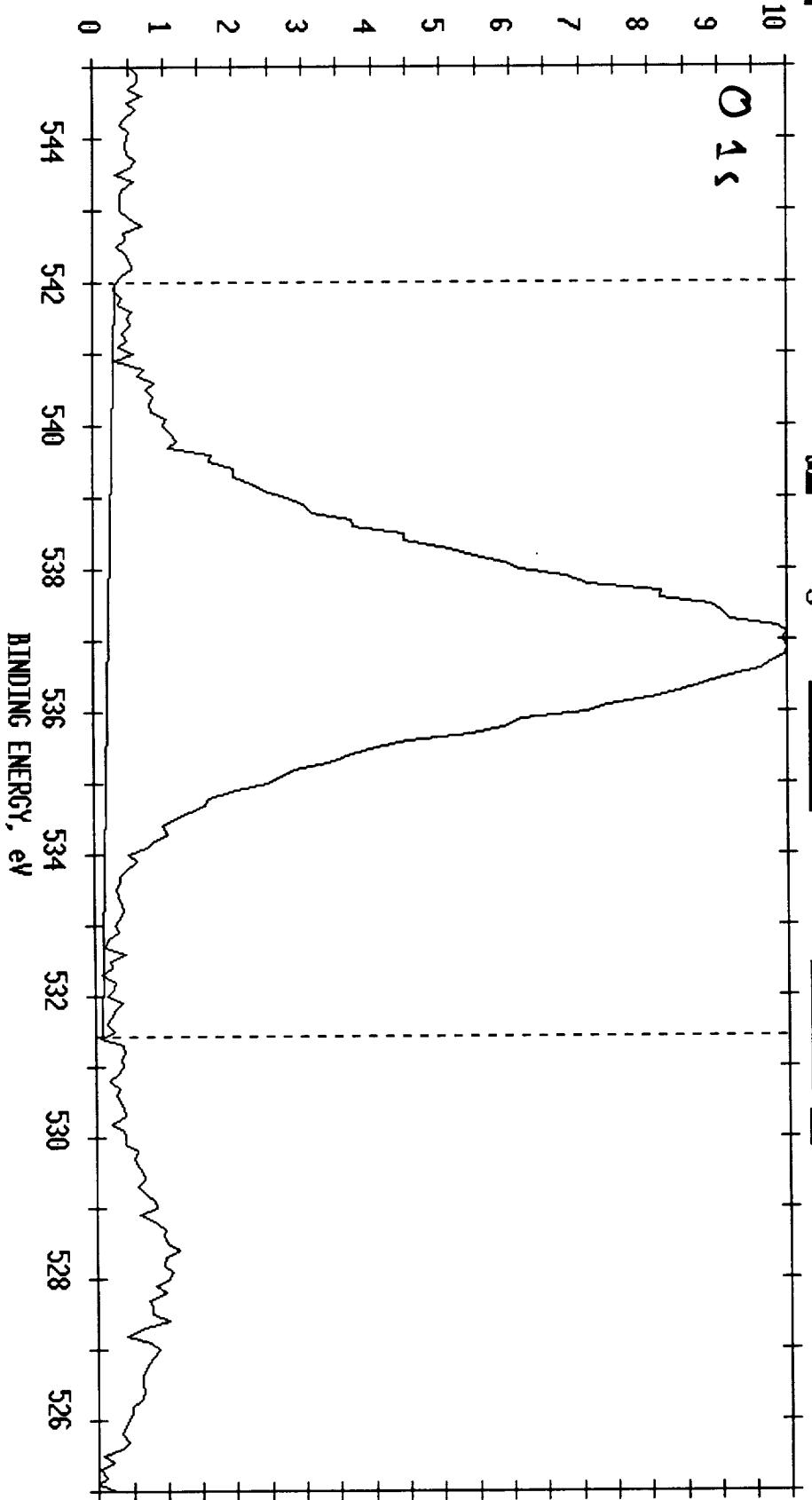
Technique: ESCA
 1/28/92 14:40

Atomic Concentration

b Element Name

a User Settings	Previous	New
c Mode	d Baseline	Linear
e Regions	f	Integrated
g Left	h Right	i
j	k	Entered Counts
l	m	Entered Counts
o	p	Entered Counts
q	r	Entered Counts
s	t	Entered Counts
u	v	Entered Counts
w	x	Entered Counts
y	z	Entered Counts
0	1	2
2	3	4
3	5	6
4	7	8
5	9	10

N(E)/E

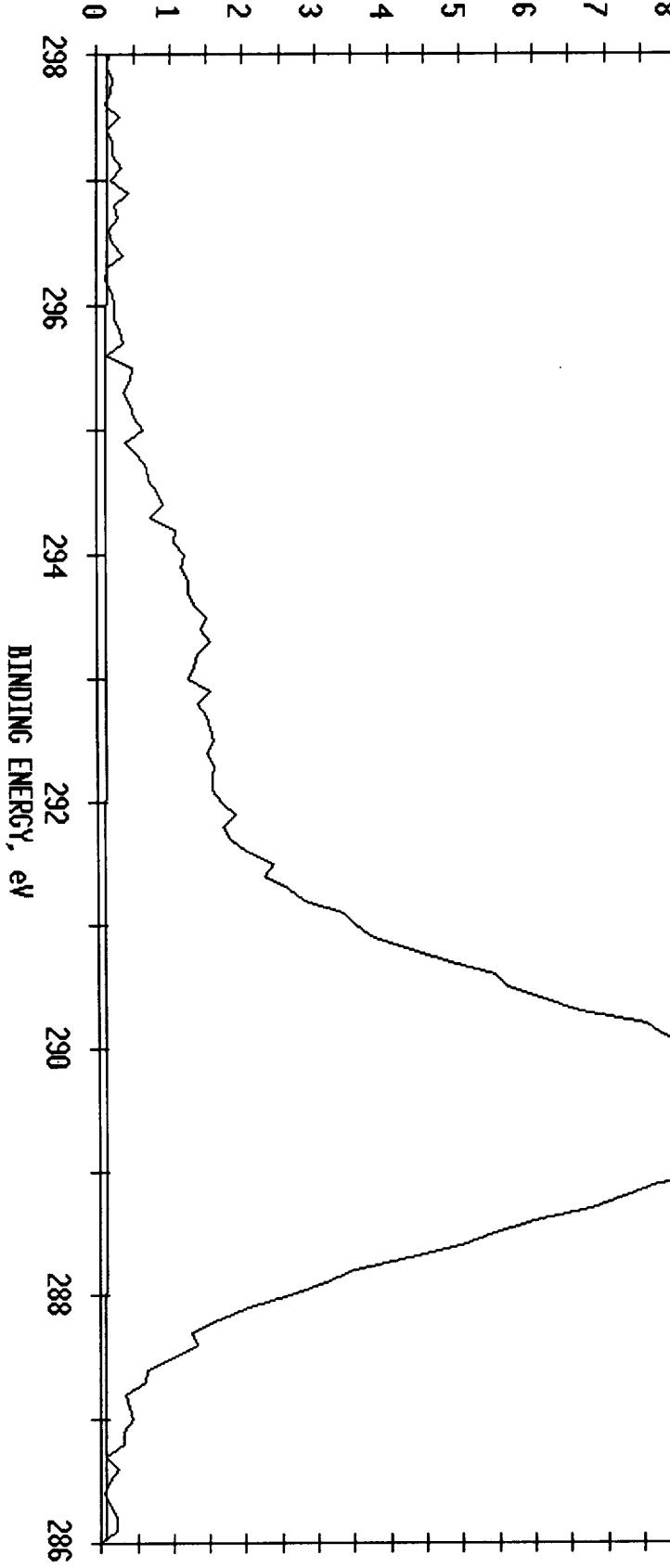


Atomic Concentration

b Element Name ■

a	User Settings	Previous	New
c	Mode	Height	d Baseline
e	Regions	01	C1 Si1 Na1 C11 N1 F1
f	Left		Mg1 Al1 Mg2
i	Right		298.00 Counts 286.00 Counts
		h Entered Counts	1774 h 1704 k
		j Analysis	Entered Counts 1760 k 1734 l

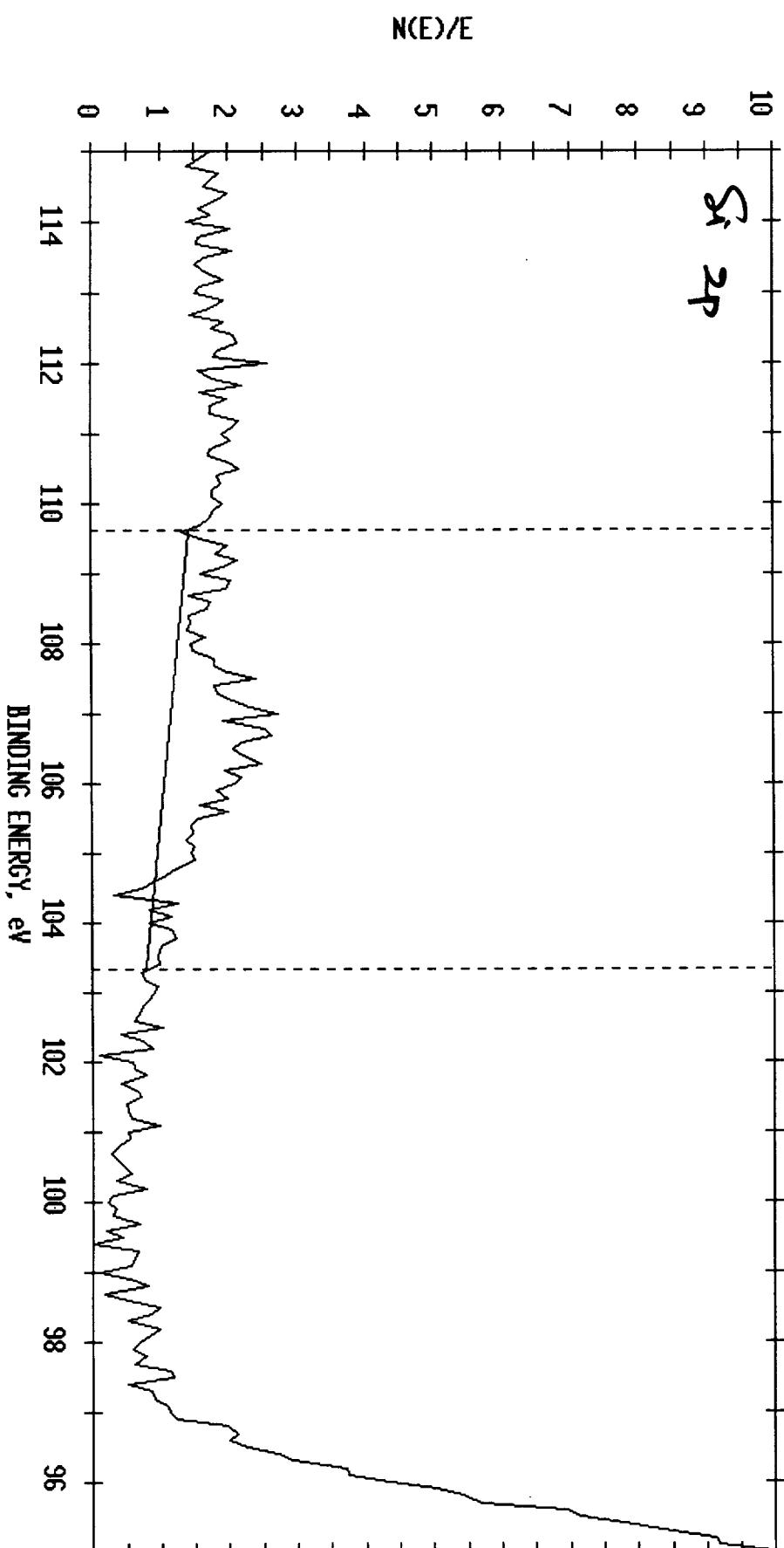
NCE/E



Atomic Concentration

b Element Name

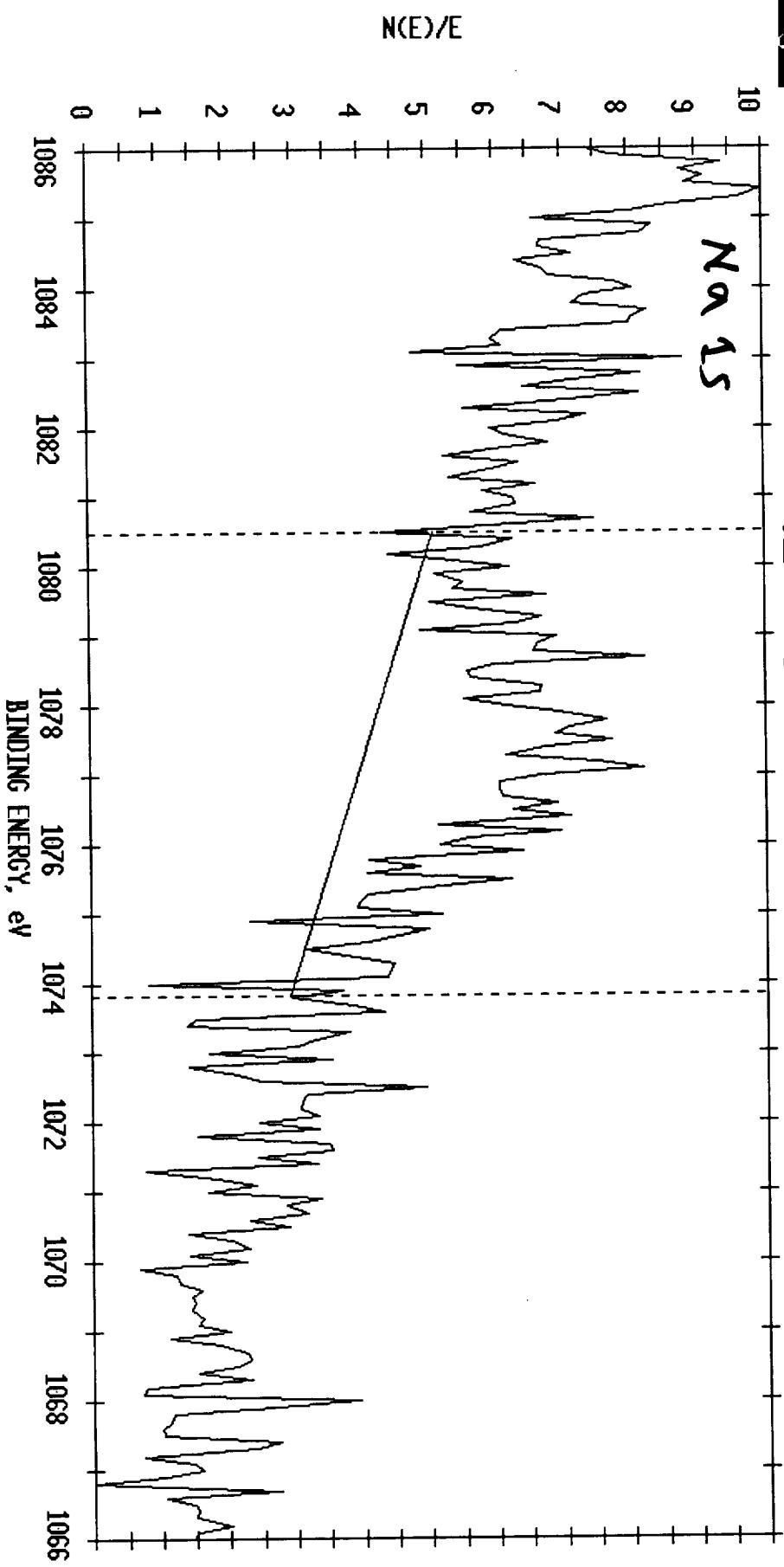
User Settings	Previous	New
Mode	Area	Height
Regions	01	C1
Left	Sil	Na1
Right	C11	Mg1
	All	Al1
	Mg2	
Linearity	Linear	Integrated
N(E)/E	NI	F1
Analysis	109.60	Counts
Analysis	103.30	Entered Counts
	1522	h
	1416	k
	1538	Entered Counts
	1421	Entered Counts

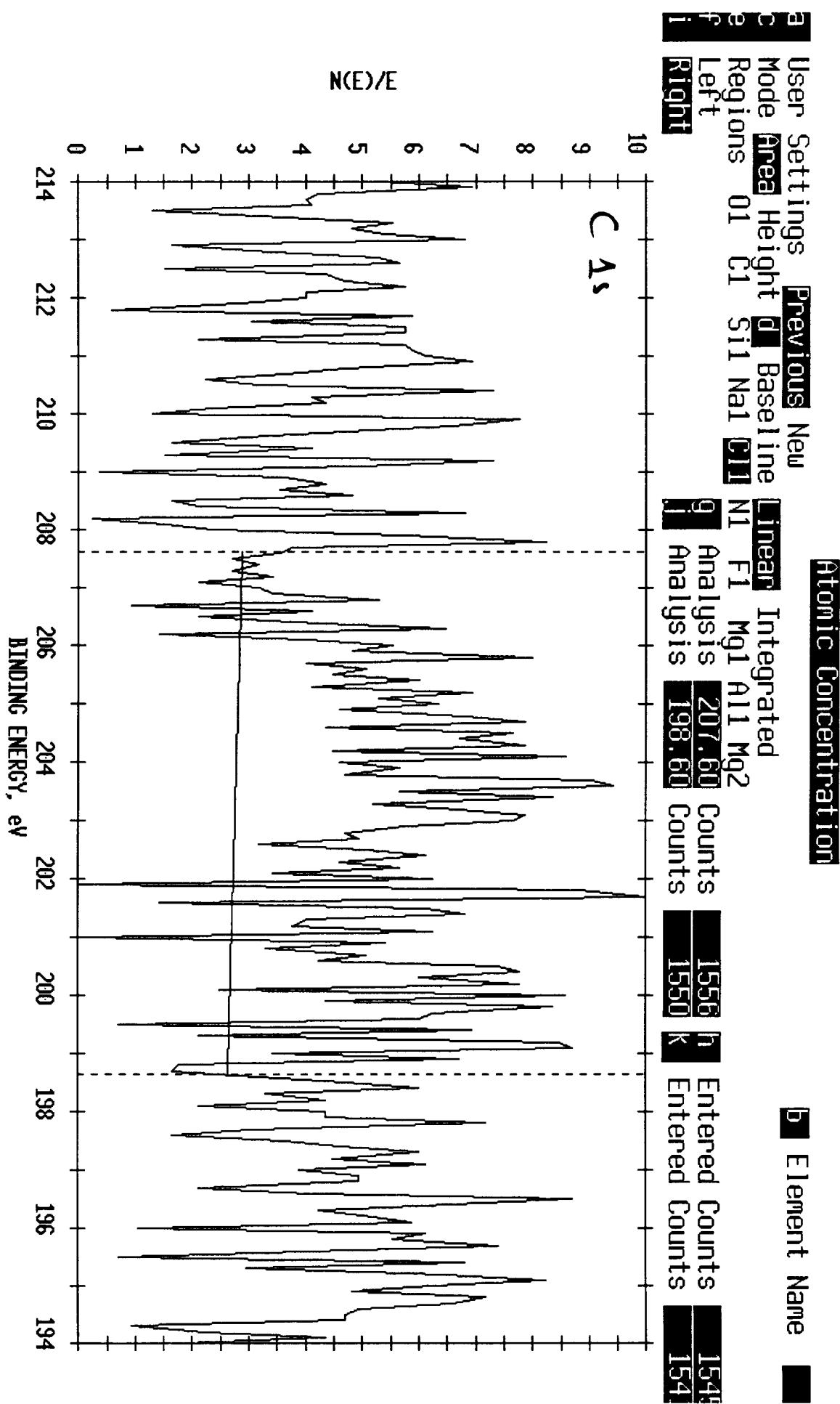


Atomic Concentration

b Element Name ■

a User Settings Previous New
Mode Area Height Line Baseline Integrated
Regions 01 C1 Si1 Na1 Mg1 Al1 Mg2
f Left Right
g Analysis 1080.50 Counts 12954 h Entered Counts 13051
j Analysis 1073.80 Counts 12780 k Entered Counts 1277



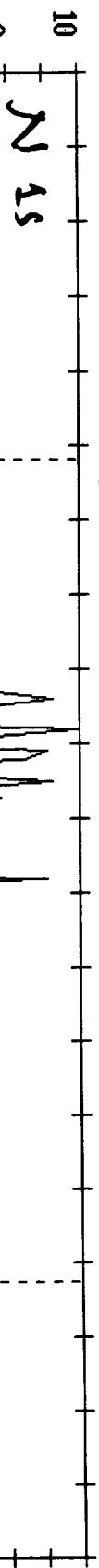


Atomic Concentration

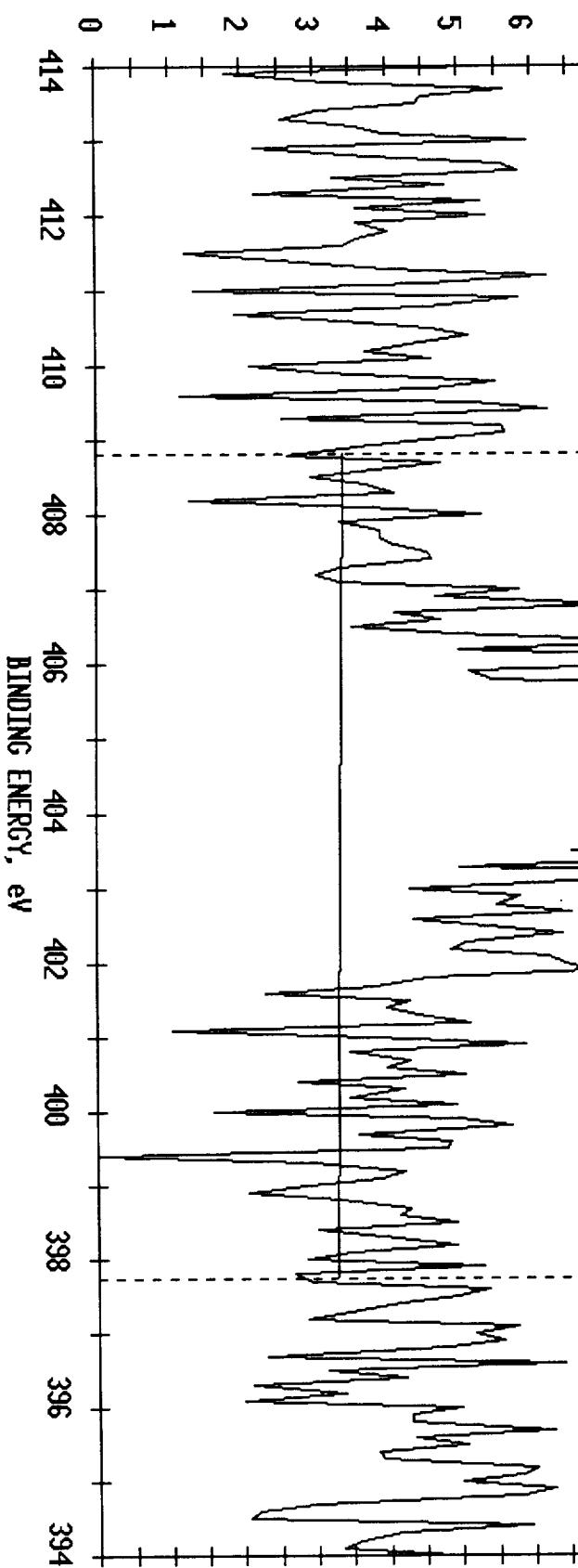
b Element Name ■

a	User Settings	Previous	New
c	Mode Area	Height	Baseline
e	Regions	01 C1 Si1 Na1 C11	Linear
f	Left	Mg1 Al1 Mg2	Integrated
i	Right	408.80	Counts
j		397.70	Counts
g		1762	Entered Counts
h		1772	Entered Counts
k		1780	Entered Counts
l		1783	Entered Counts

N(E)/E



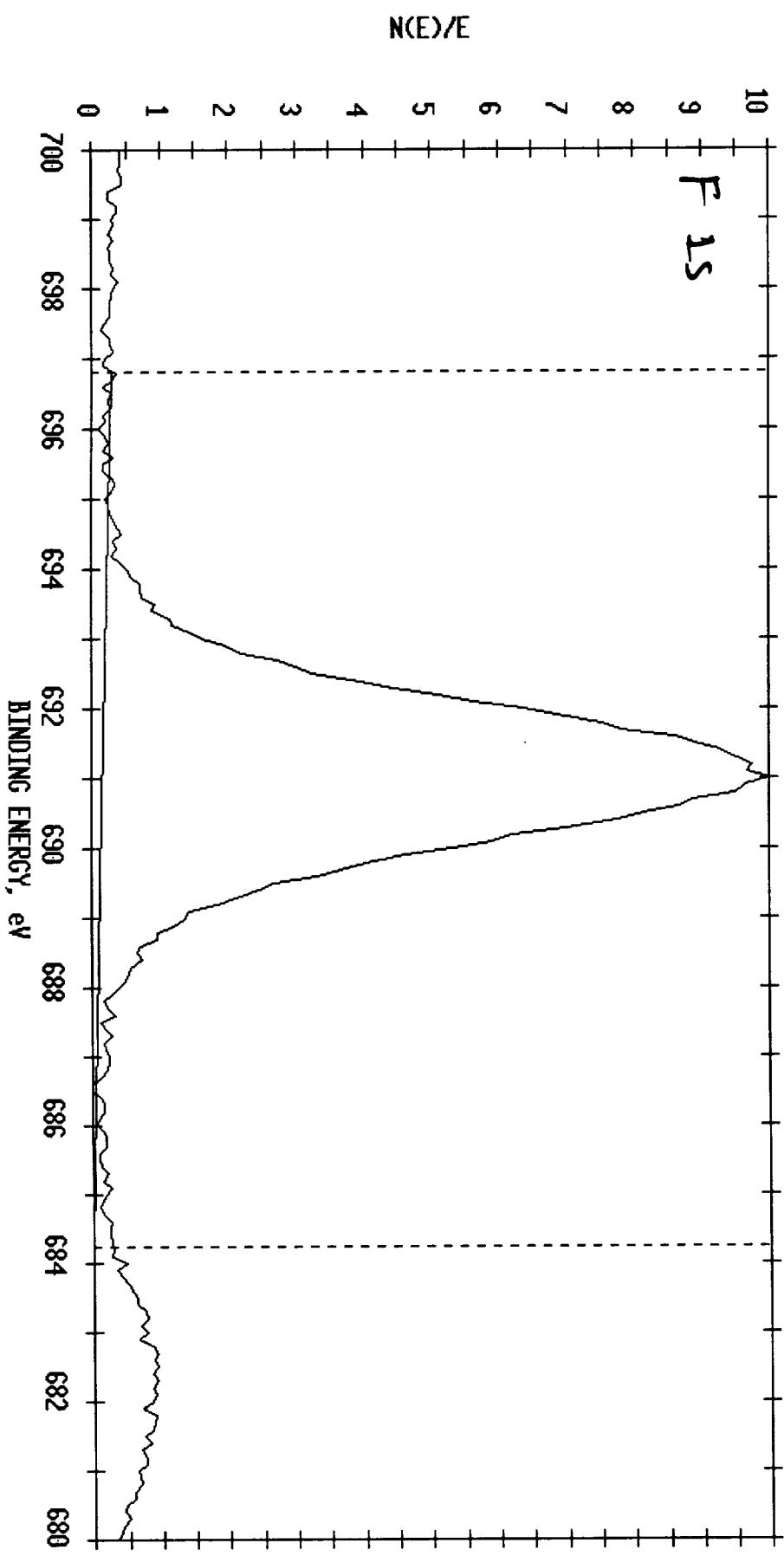
N ls



Atomic Concentration

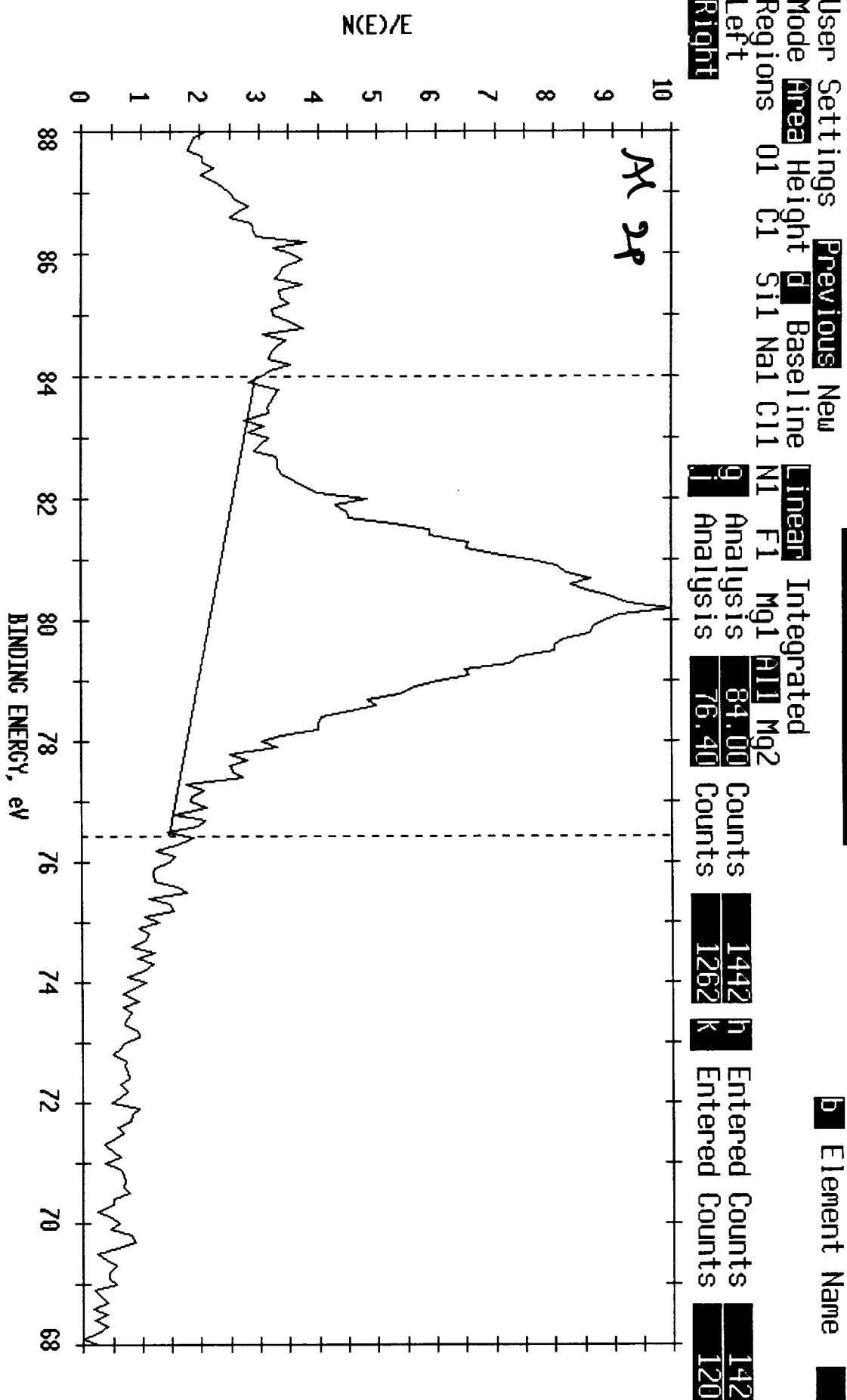
b Element Name ■

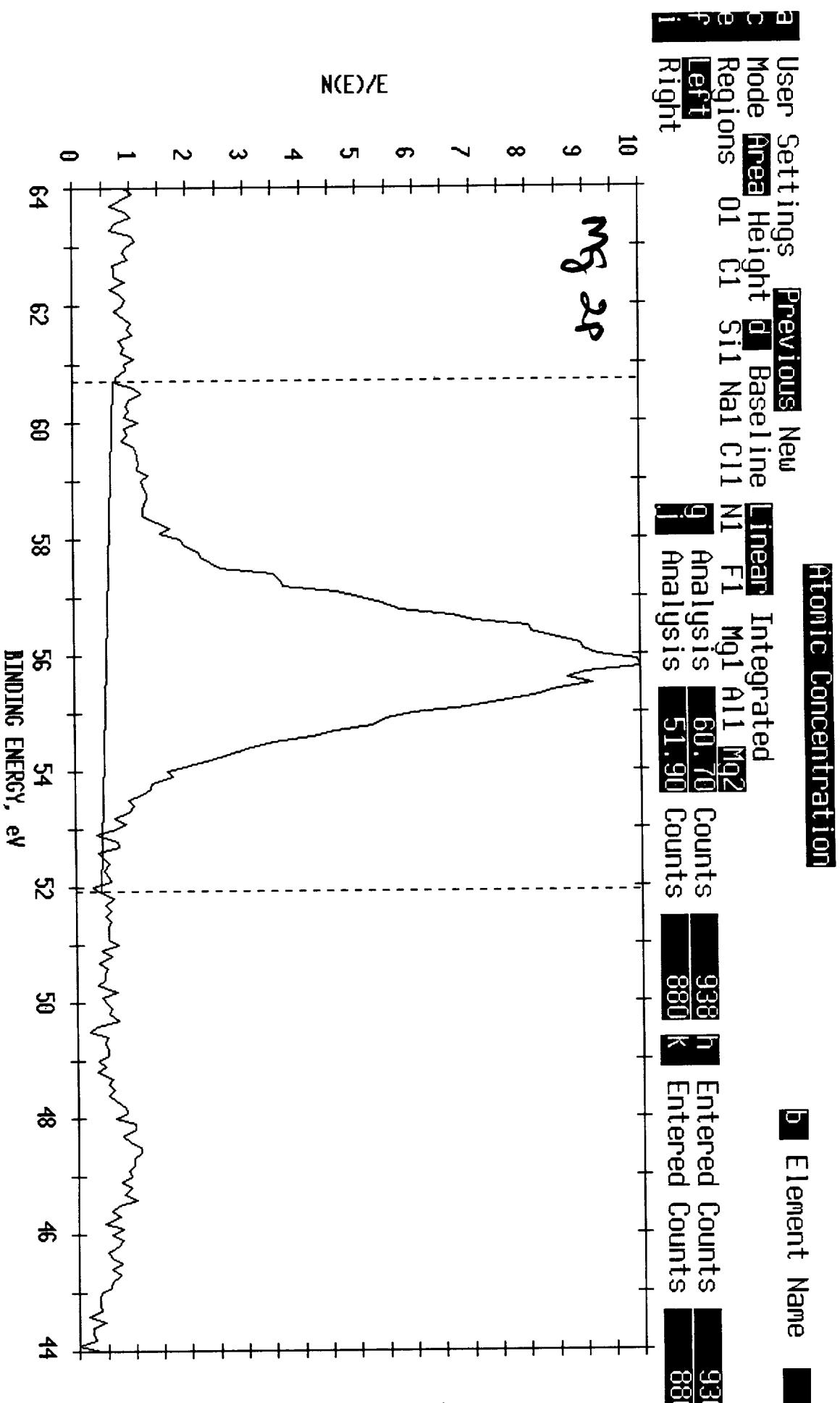
a User Settings	Previous	New
c Mode Area	d Baseline	Linear
e Regions	01 C1 Si1 Na1 Cl1 N1	f Mg1 Al1 Mg2
g Left	g Analysis	Counts 696.80
i Right	j Analysis	Counts 684.20
h Entered Counts	7430	7354
k Entered Counts	7362	6962



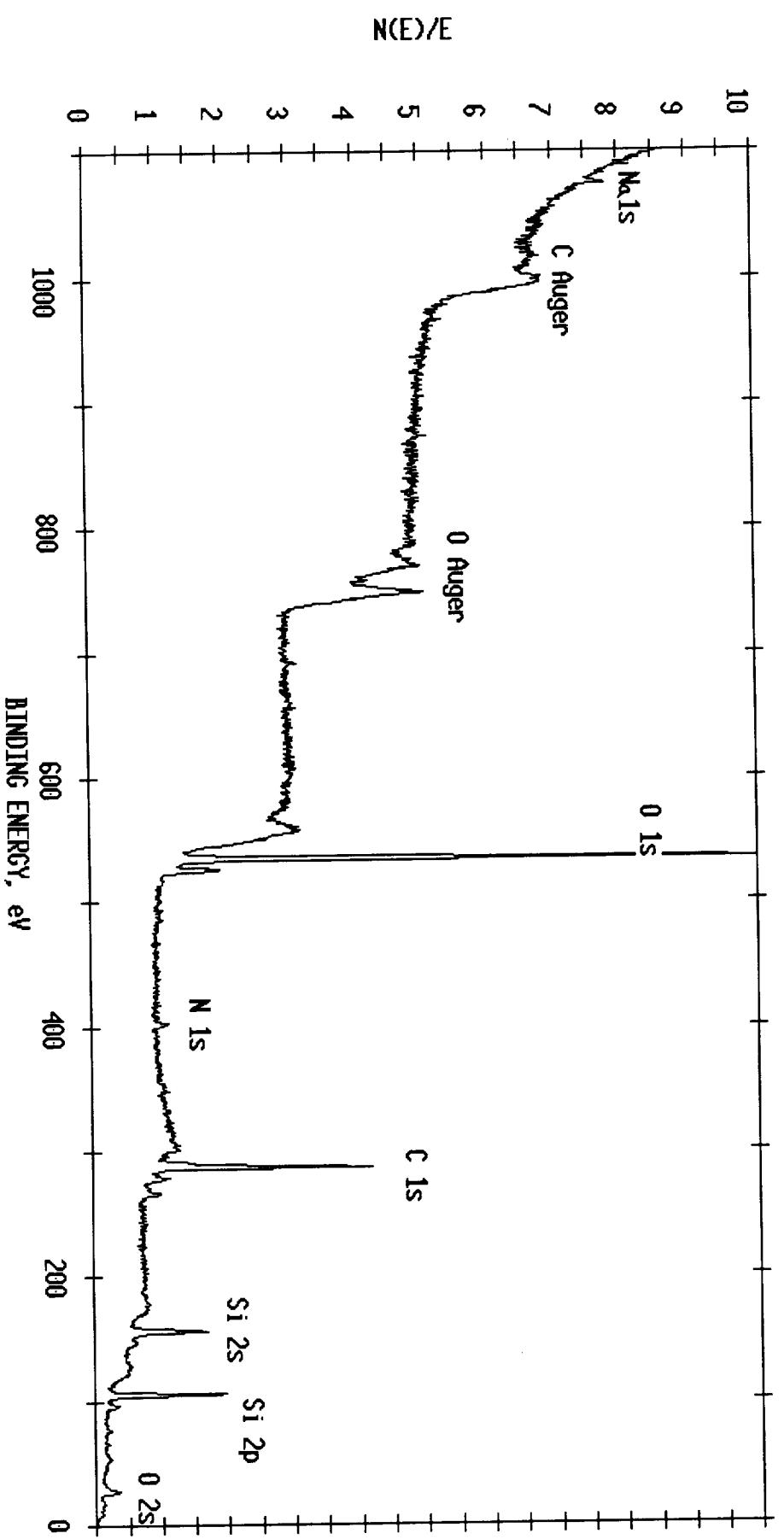
Atomic Concentration

E	User Settings	Previous	New
C	Mode	Height	Baseline
G	Regions	01	C1
F	Left	Si1	Na1
I	Right	C11	All
D		Mg1	Mg2
J		NI	84.00
H		F1	Counts
L		Mg1	1442
G		All	Entered Counts
I		NI	142
K		F1	Entered Counts
M		Mg1	1262
N		All	1200





ESCA SURVEY 1/28/92 ANGLE= 45 deg ACQ TIME=4.59 min
FILE: MgF₂_3 NASA, MgF₂, Control, BACKSIDE 23-90, REF ONLY
SCALE FACTOR= 15.358 k c/s, OFFSET= 3.280 k c/s PASS ENERGY= 89.450 eV Mg 250 μ



Print
AC Table AC Table

Exclude
Region
Atomic Concentration
Display Curve
More Softkeys
AC to AC Summary
Exit

a User Settings Previous New
c Mode Area Height d Baseline Linear Integrated
e Regions O1 C1 Sil Nal C11 N1 F1

b Element Name

File: MgF2_4
Lens: Large Area Omni-Focus
NASA, MgF2, Control, BACKSIDE 23-90, REF ONLY
Source: Standard

Element	Area (cts-eV/s)	Sensitivity Factor	Concentration (%)
O1s	45256	0.711	37.52
C1s	20822	0.296	41.47
Si2p	9428	0.339	16.39
N1s	3160	1.685	1.11
Cl2p	1050	0.891	0.69
N1s	2012	0.477	2.49
F1s	564	1.000	0.33

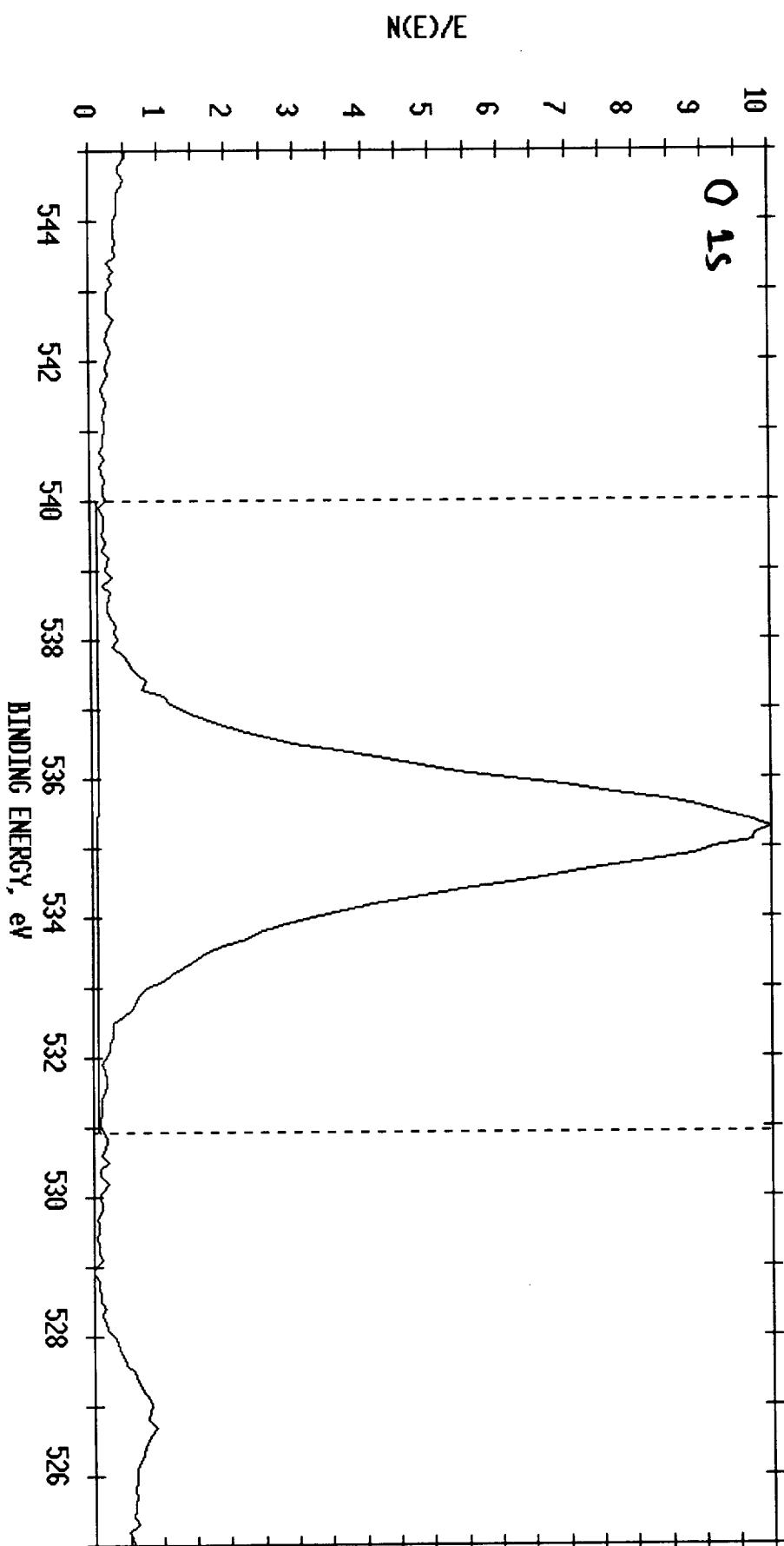
Ion Gun: OFF X-ray: OFF Mg
0.5mPa

Technique: ESCA
1/28/92 14:40

Atomic Concentration

b Element Name ■

a User Settings Previous New
Mode Area Height Baseline Linearity
Regions 01 C1 Si1 Na1 Cl1 F1
f Left i Right
g Analysis 540.00 Counts h Entered Counts 1718
j Analysis 530.90 Counts k Entered Counts 1692

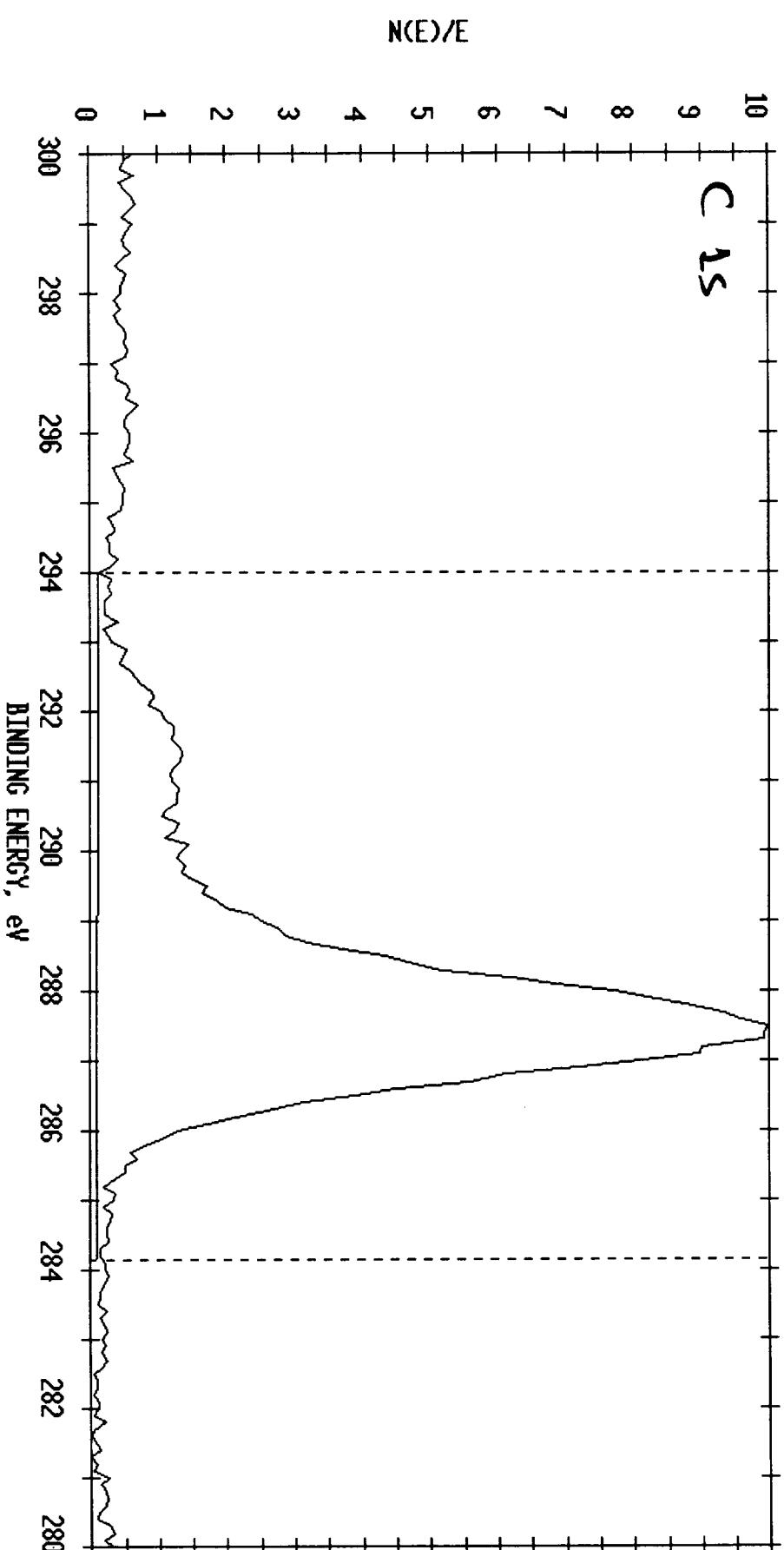


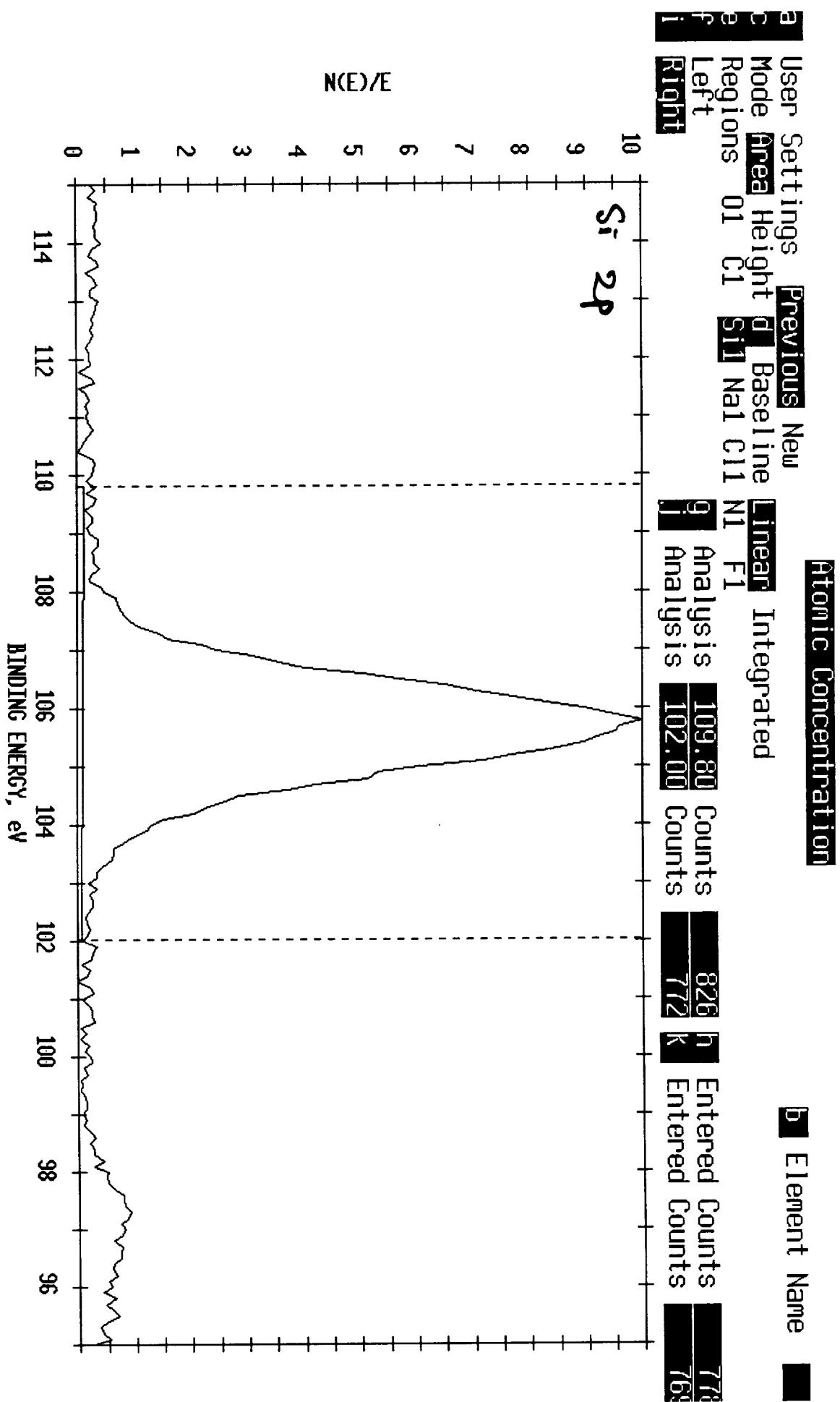
Atomic Concentration

b Element Name █

a User Settings Previous New
Mode Area Height Lineal Integrated
Regions 01 C1 Sil1 Na1 Cl1 Ni F1
Left Right

9 Analysis 294.00 Counts 1438 h Entered Counts 1432 k Entered Counts 1418





Atomic Concentration

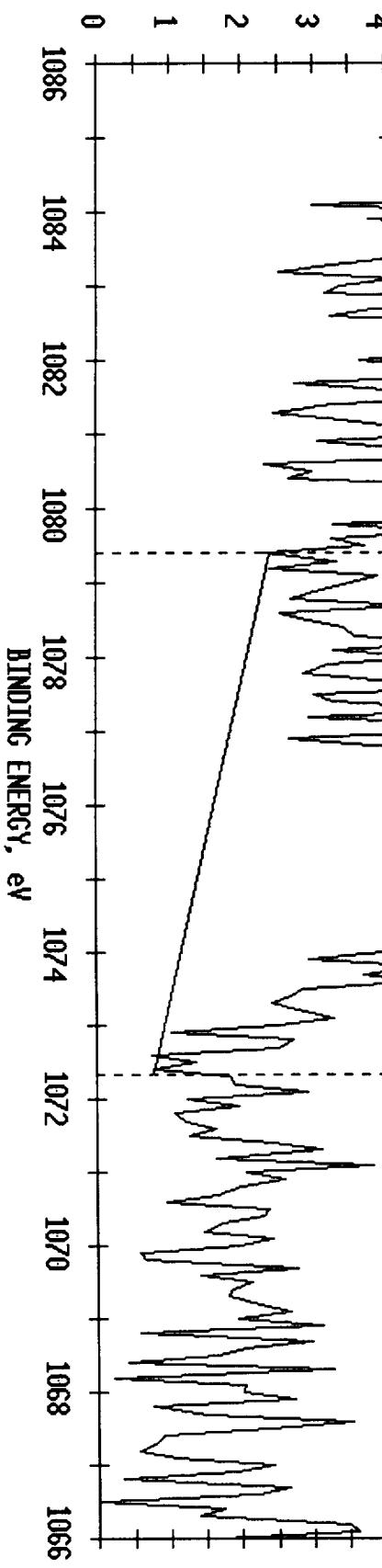
B Element Name

a User Settings
c Previous New
Mode Area Height
e Regions 01 C1 Si1 Na1 Cl1 Ni F1
f Left
i Right
j Analysis 1079.40 Counts 5596 h Entered Counts 5601
k Analysis 1072.30 Counts 5560 k Entered Counts 548

N(E)/E

10
9
8
7
6
5
4
3
2
1
0

Na 1s



Atomic Concentration

b Element Name

a User Settings
c Mode Area Height d Baseline
e Regions 01 C1 Si1 Na1 Cl1 f M1 F1
i Left Right

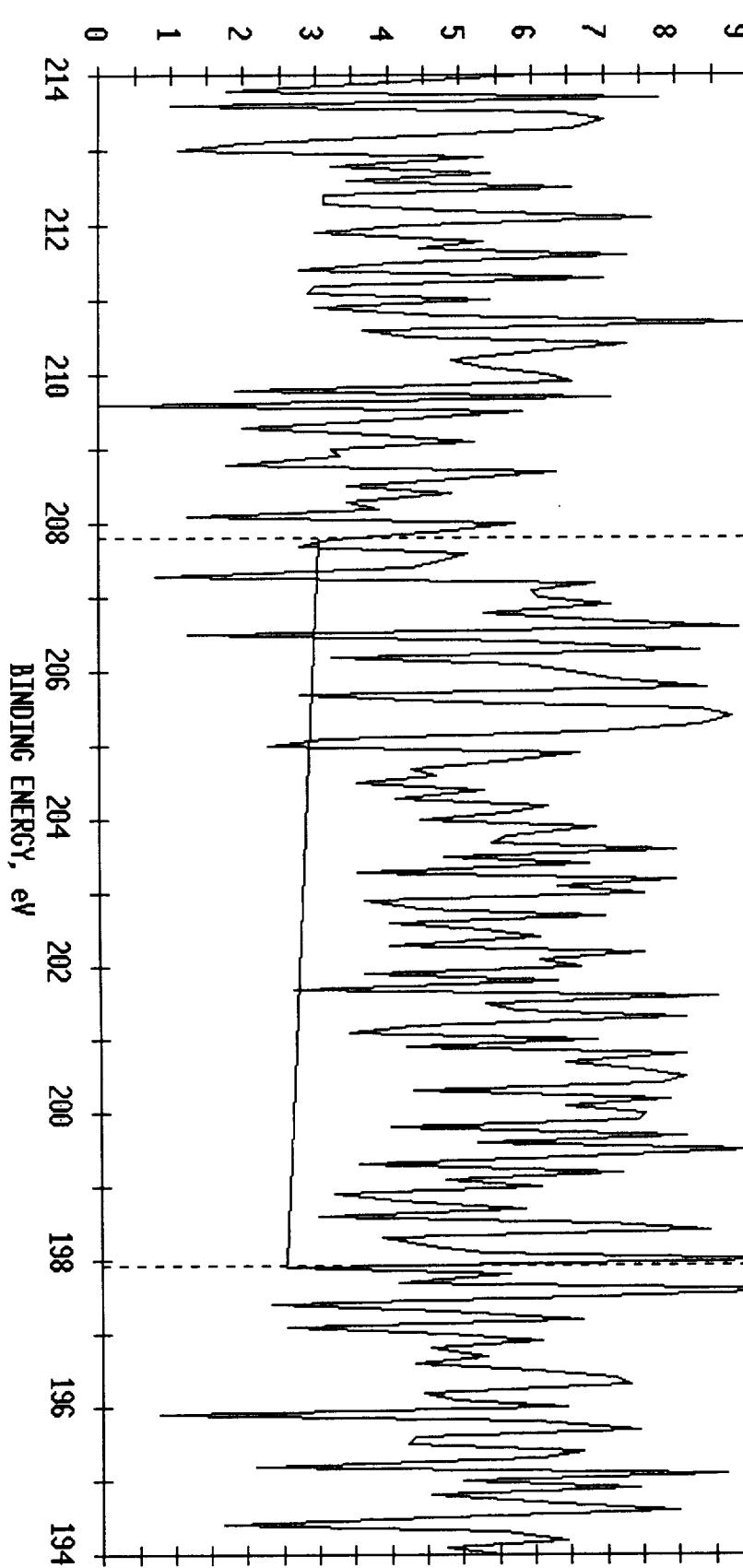
Previous New
Linear Integrated

g Analysis 207.80 Counts 1250 h Entered Counts 124
j Analysis 197.90 Counts 1238 k Entered Counts 123

N(E)/E

10
9
8
7
6
5
4
3
2
1
0

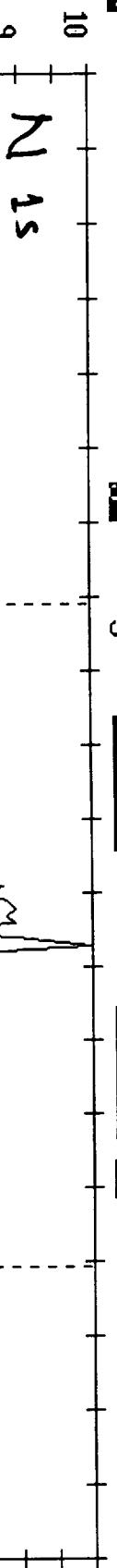
Cl 2P

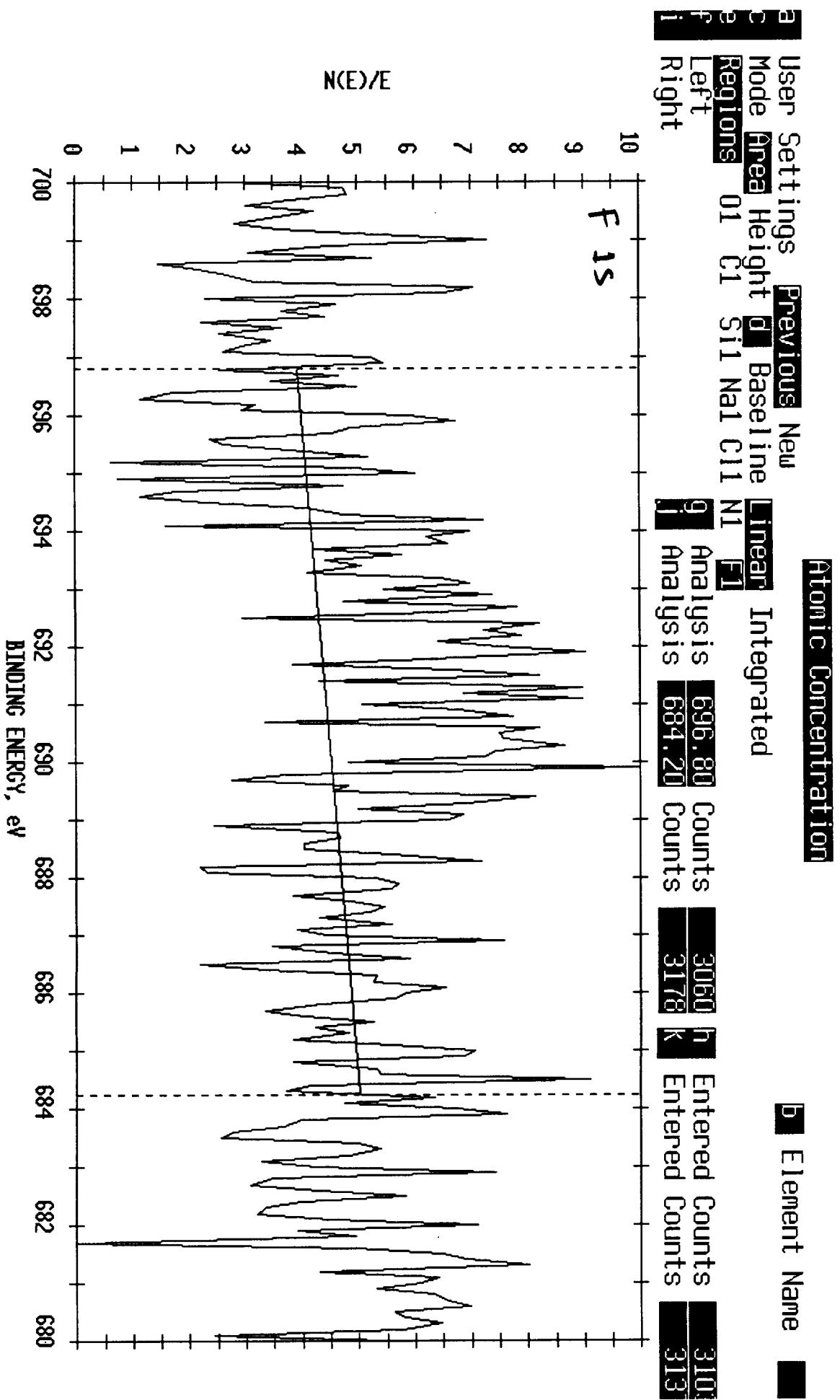


Atomic Concentration

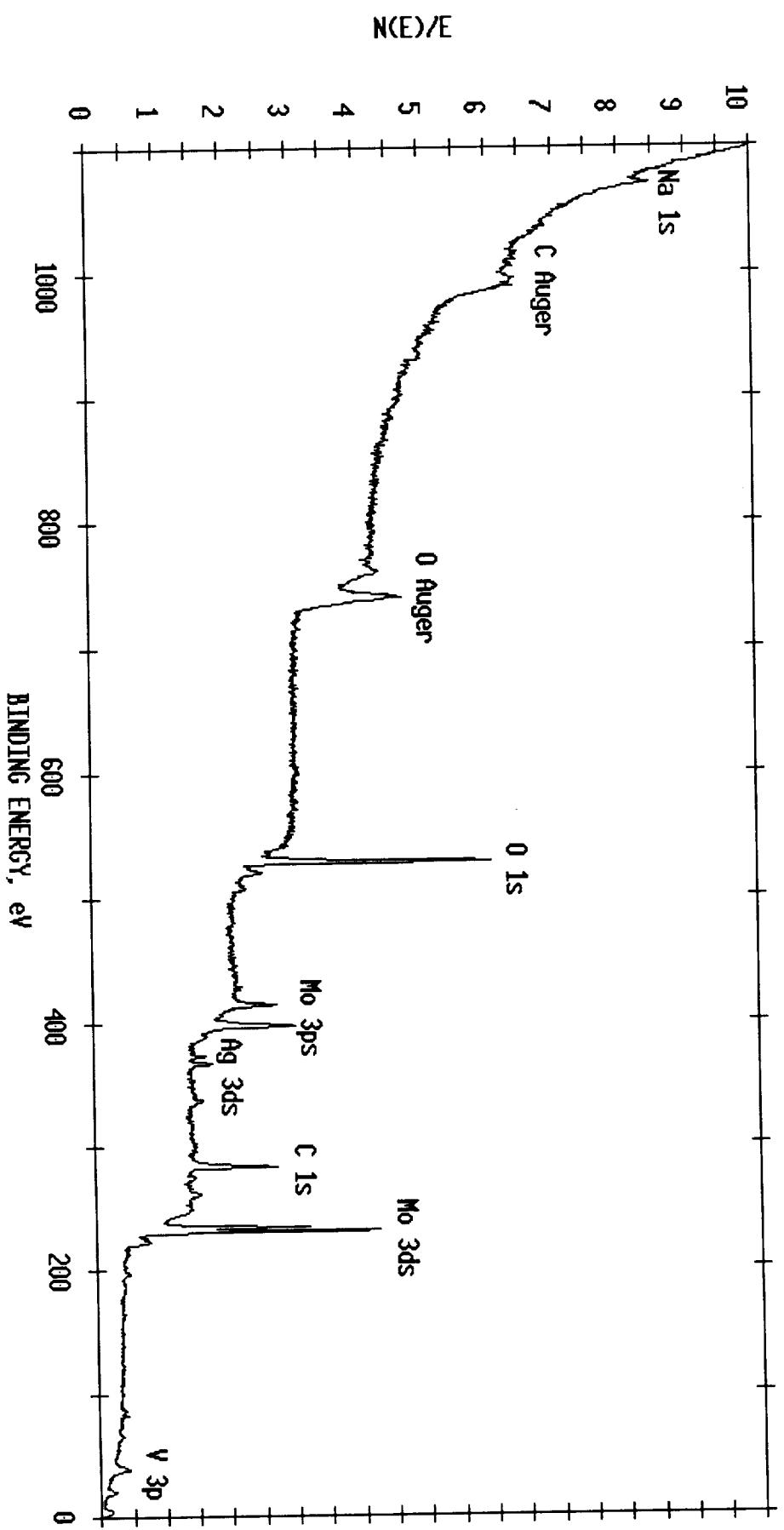
b Element Name

a	User Settings	Previous	New
c	Mode Area	Height d	Baseline
e	Regions	01 C1	Si1 Na1 C11
f	Left	N1	F1
i	Right	Analysis	Analysis
		406.90 Counts	397.90 Counts
		1416 h Entered Counts	1446 k Entered Counts
		1420	1410





ESCA SURVEY 1/23/92 ANGLE= 45 deg ACQ TIME=4.59 min
FILE: Van1_x_1 NASA, Vanadium LDEF, Exposed Region
SCALE FACTOR= 30.582 k c/s, OFFSET= 4.960 k c/s PASS ENERGY= 89.450 eV Mg 250 W



Print
AC Table AC Table

Exclude
Region
Atomic Concentration
Display Curve
More Softkeys
AC to AC Summary
Exit

a User Settings Previous New
c Mode Area Height d Baseline Linear Integrated
e Regions O1 C1 Si1 Na1 Cl1 F1 Ag1 Mo1 V2

File: Van1_x_5
Lens: Large Area Omni-Focus
Source: Standard

Atomic Concentration Table

NASA, Vanadium LDEF, Exposed Region

Element	Area (cts-eV/s)	Sensitivity Factor	Concentration (%)
O1s	27474	0.711	31.42
C1s	12624	0.296	34.68
Si2p	510	0.339	1.22
Na1s	6816	1.685	3.29
Cl2p	1076	0.891	0.98
F1s	688	1.000	0.56
Ag3d	5234	5.987	0.71
Mo3d	47308	3.321	11.58
V3p	5144	0.269	15.55

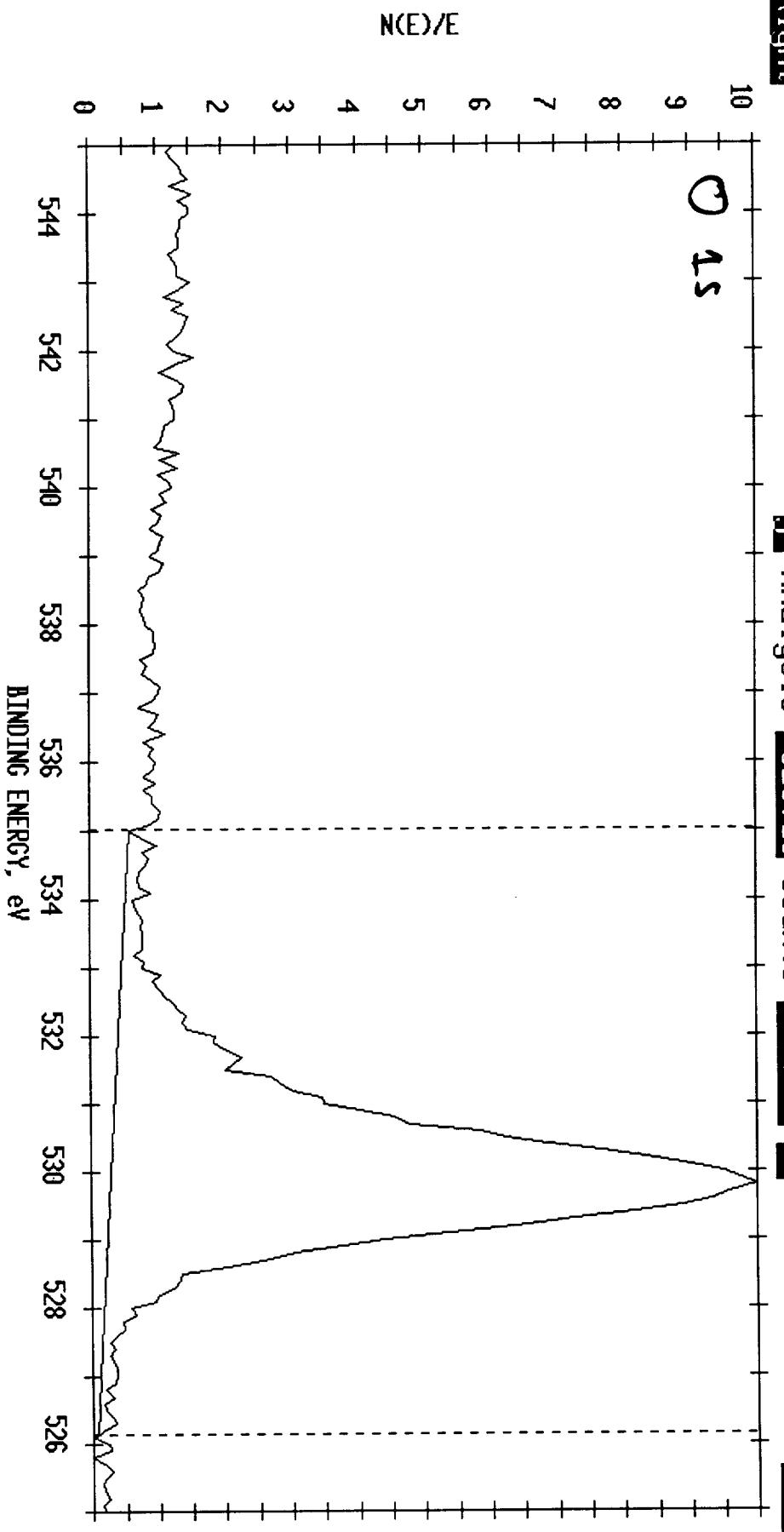
Ion Gun: OFF X-ray: OFF Mg
0.5mPa

Technique: ESCA
1/28/92 9:33

Atomic Concentration

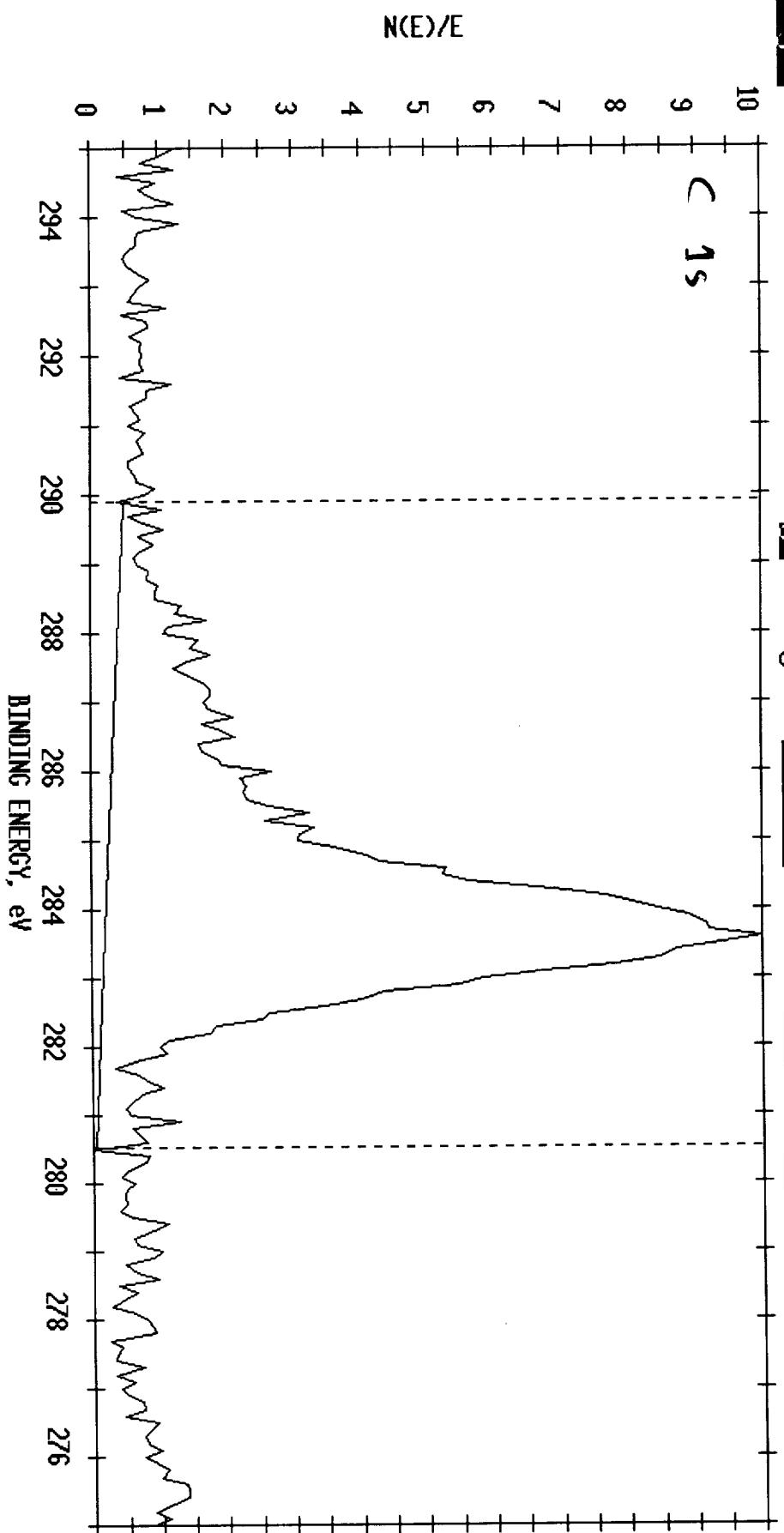
b Element Name

a	User Settings	Previous	New
c	Mode	d Area	Baseline
e	Regions	01	Linear
f	Left	C1	Integrated
i	Right	Si1 Na1 Cl1	
g		F1 Ag1 Mo1 V2	
j		Analysis	
l		535.00	Counts
		526.10	Entered Counts
		5022	h
		4614	k Entered Counts
		5020	Entered Counts
		4664	



Atomic Concentration

a	User Settings	Previous	New
c	Mode	Area	Height
e	Regions	01	C1
f	Left	Si1	Na1
i	Right	C11	Cl1
b	Element Name		
d	Baseline	Linear	Integrated
f	F1	Ag1	Mg1
g	Analysis	289.90	Counts
j	Analysis	280.50	Counts
h	Entered Counts	3038	h
k	Entered Counts	306	k
l	Entered Counts	2936	l
m	Entered Counts	2940	m



Atomic Concentration

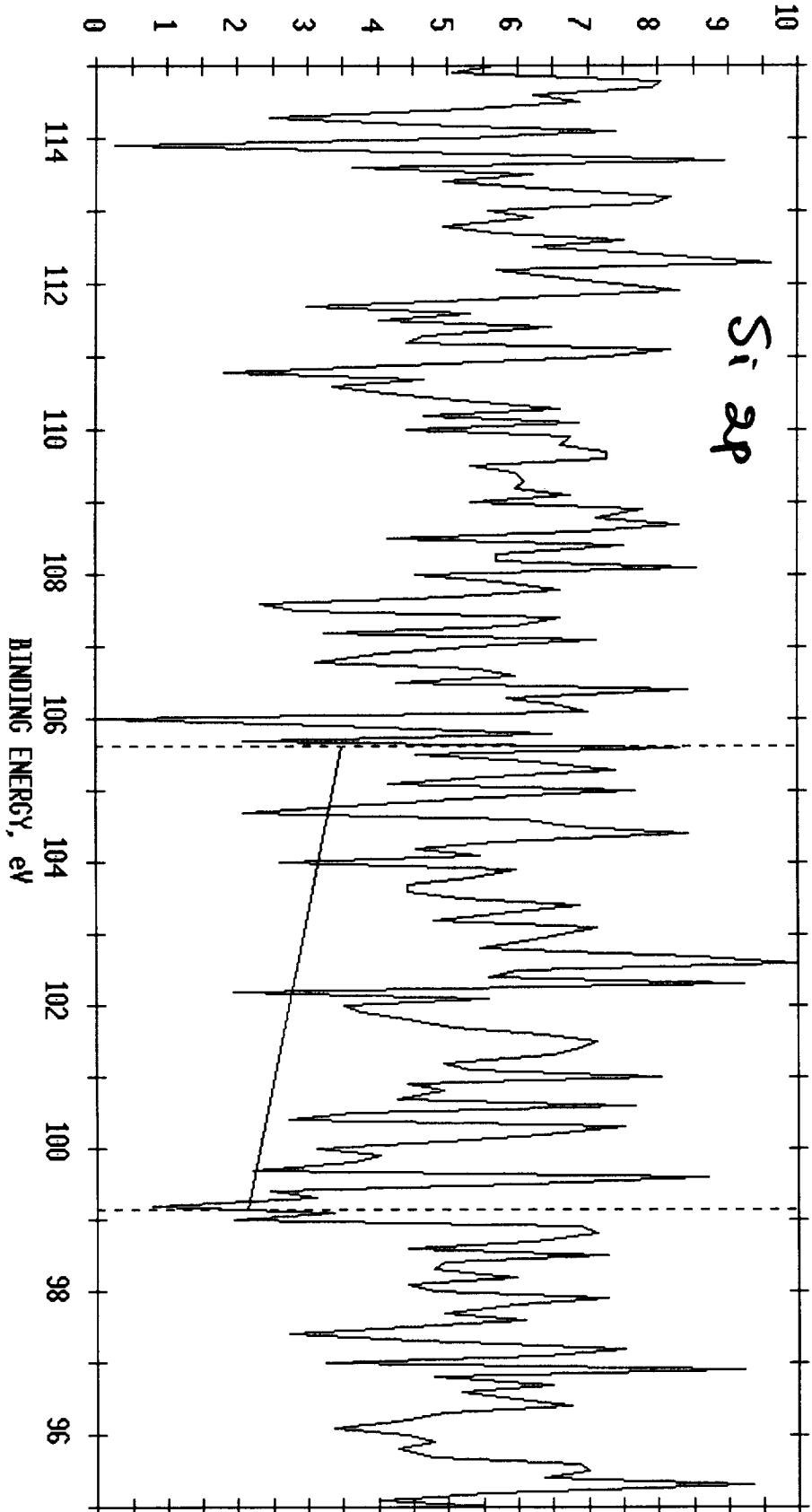
b Element Name

■

a User Settings Previous New
c Mode Area Height Lineal Integrated
e Regions 01 C1 Si1 Na1 C11 F1 Ag1 Mo1 V2
f Left Right
i Right
j Analysis 105.60 Counts 1260 h Entered Counts 1181
k Analysis 99.10 Counts 1184 k Entered Counts 1163

Si 2p

N(E)/E



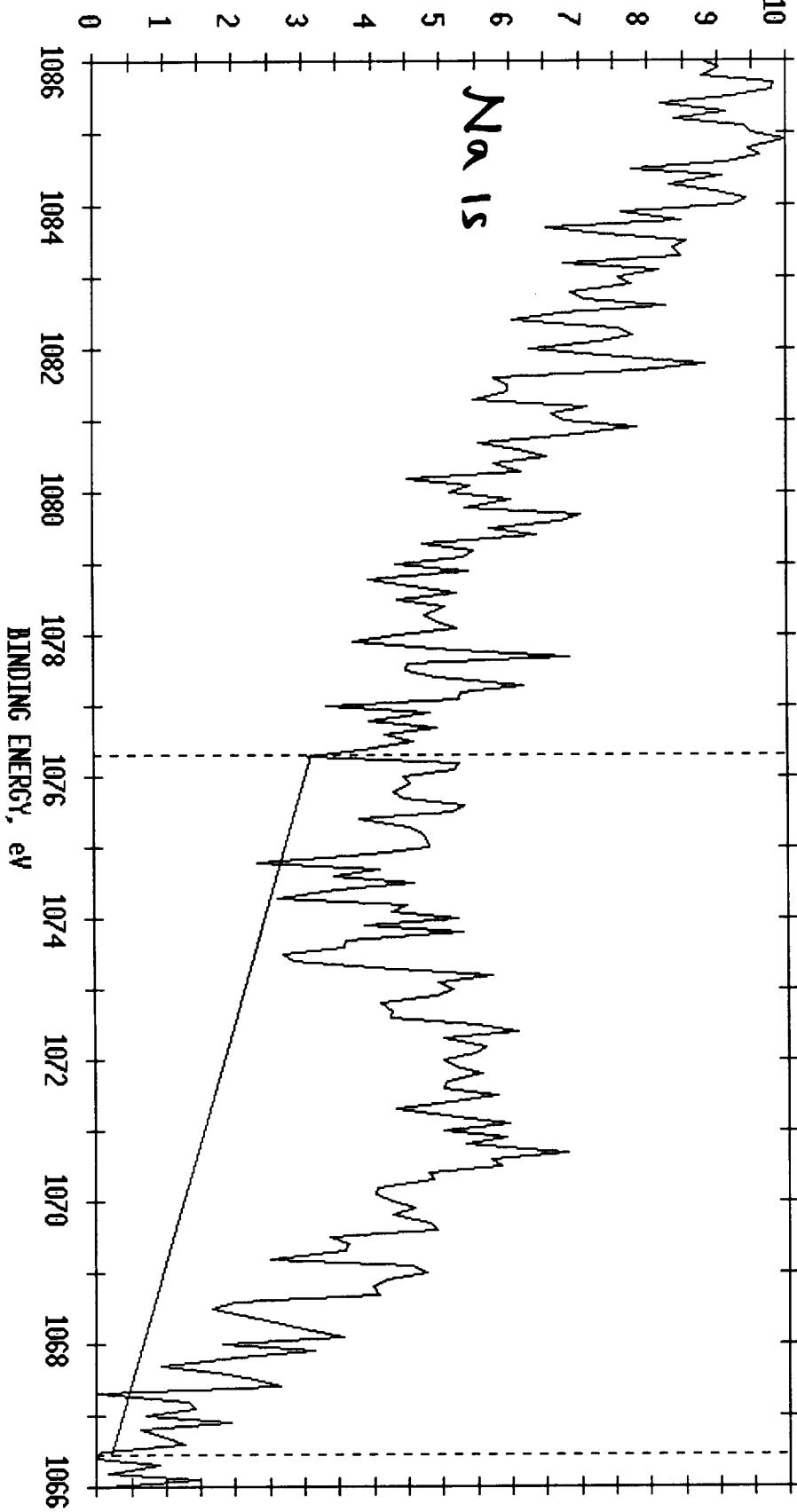
Atomic Concentration

b Element Name

a User Settings
Mode Area Height d Baseline
Regions 01 C1 Si1 Na1 Linear
f Left Right F1 Ag1 Mo1 V2
g Analysis 1076.30 Counts 12556 h Entered Counts 1256
j Analysis 1066.40 Counts 12094 k Entered Counts 1212

N(E)/E

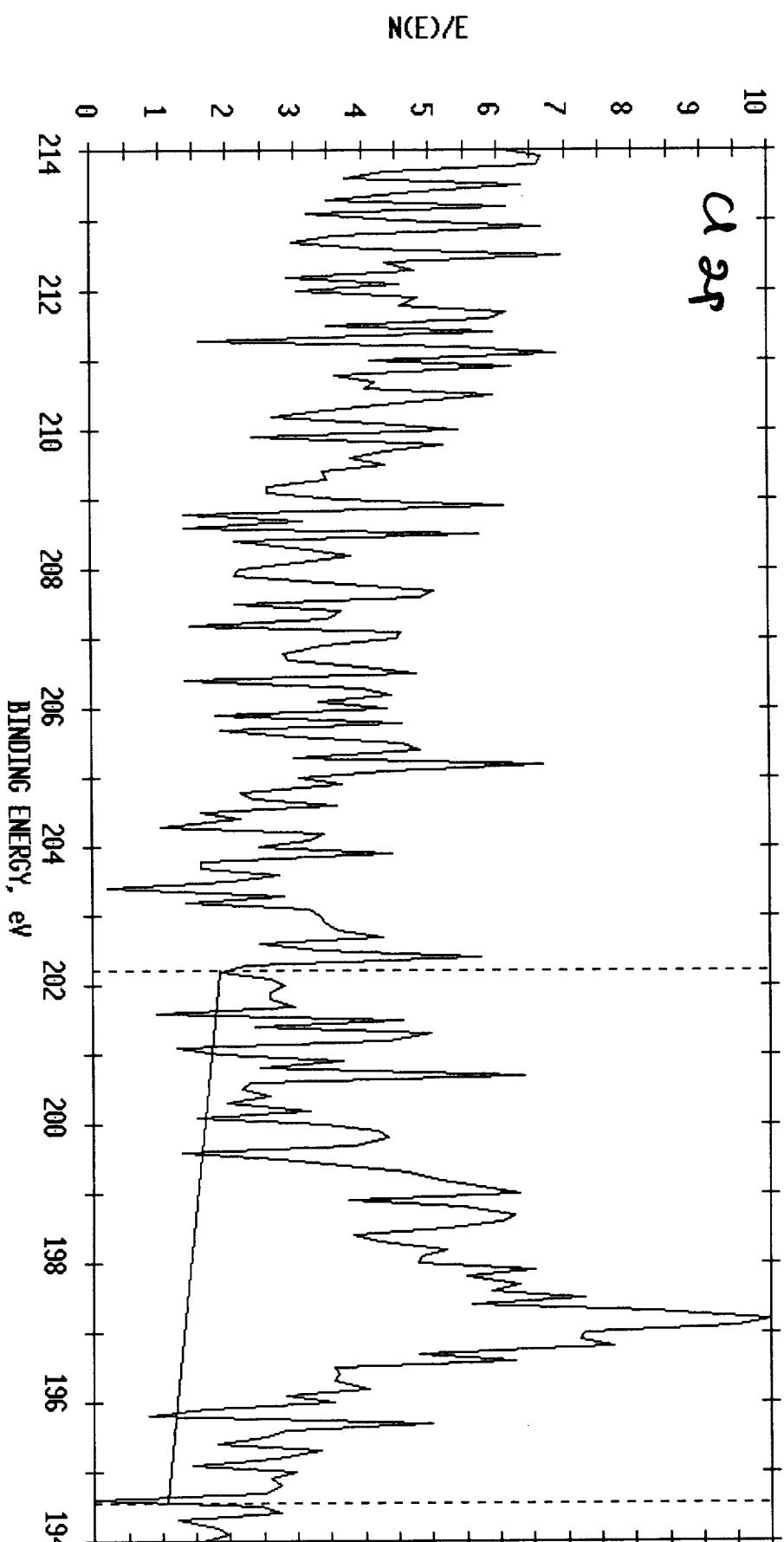
Na 1s

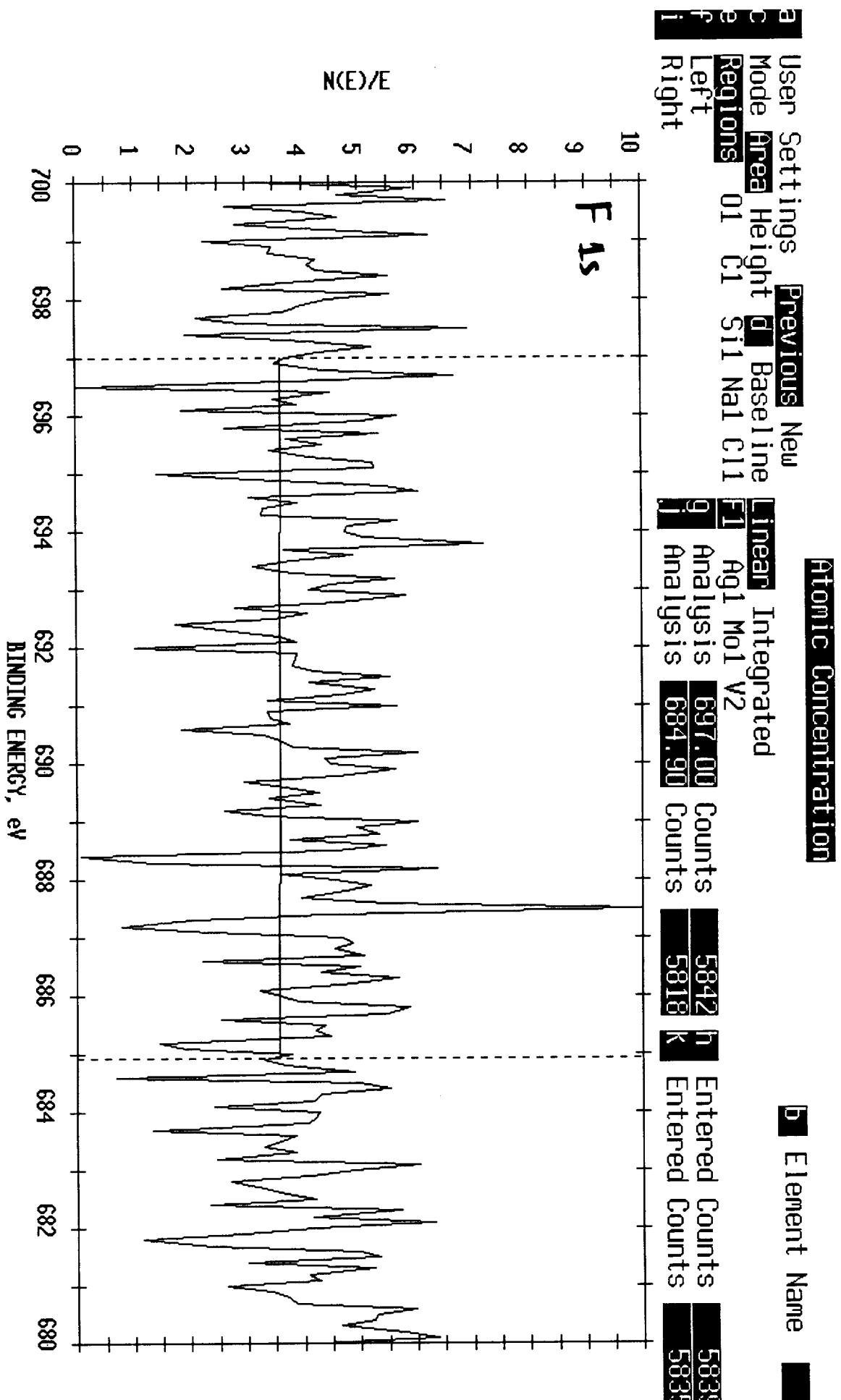


Atomic Concentration

b Element Name ■

a	User Settings	Previous	New
c	Mode Area	Height	Baseline
e	Regions	01 C1	Si1 Na1 C11
f	Left	F1 Ag1 Mo1 V2	Analys
i	Right	202.20 Counts	Analysis
g	Entered Counts	1340 h	202.20 Counts
j	Entered Counts	1356 k	194.50 Counts
l	Entered Counts	1340 l	1318



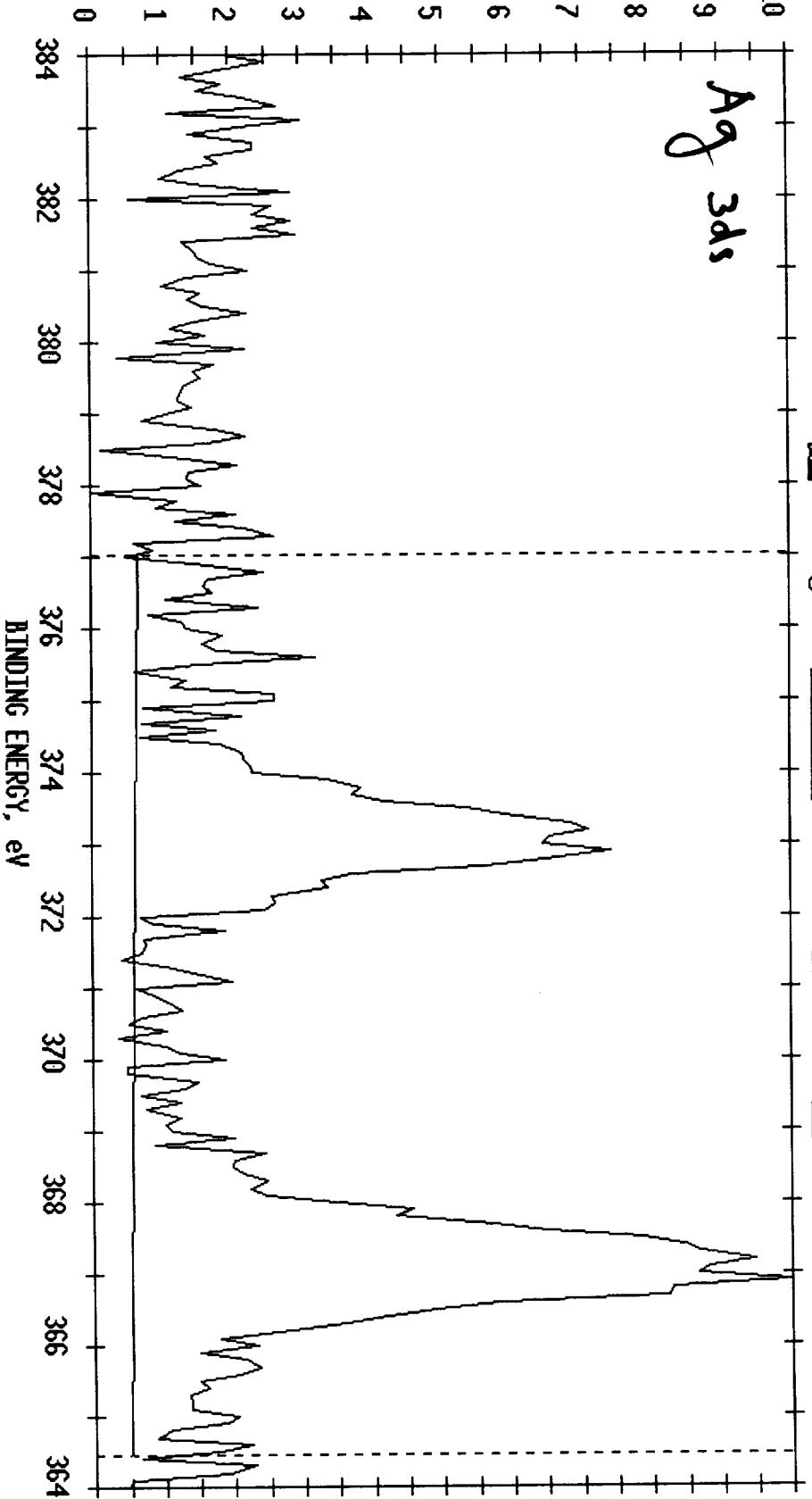


Atomic Concentration

■ Element Name ■

a	User Settings	Previous	New
c	Mode	Area	Height
e	Regions	01	C1
f	Left	Si1	Na1
i	Right	C11	F1
b	Element Name	Ag	3ds
d	Baseline	Linear	Integrated
g	Analysis	AgI	Mol V2
j	Analysis	377.00	Counts
k	Entered Counts	3158	h
l	Entered Counts	3176	k
m	Entered Counts	3170	Entered Counts
n	Entered Counts	3161	Entered Counts

N(E)/E



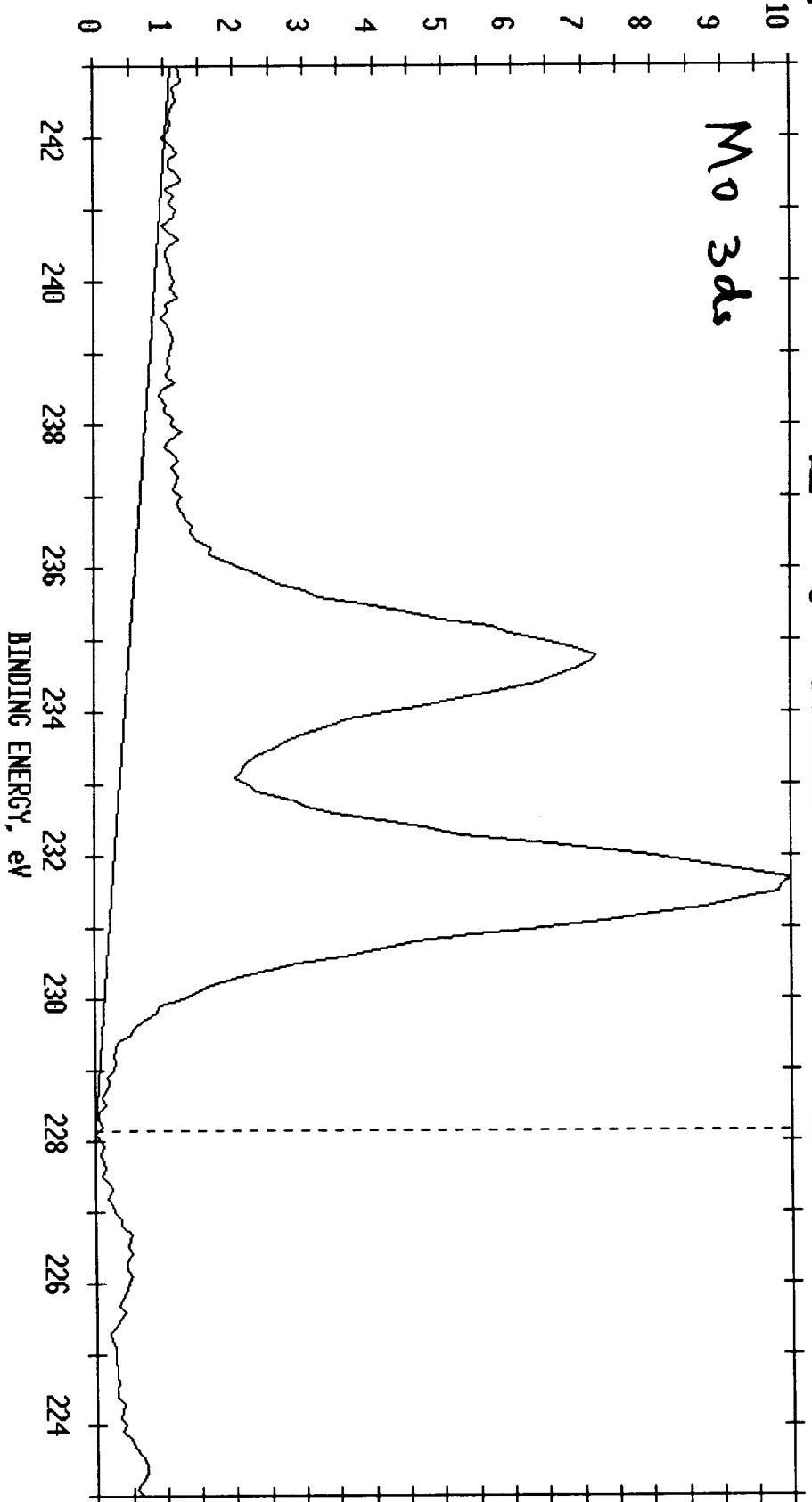
Atomic Concentration

D Element Name ■

a User Settings Previous New
Mode Area Height Lineal Integrated
e Regions 01 C1 Si1 Na1 Cl1 F1 Ag1 Mol V2
f Left Right g Analysis 243.00 Counts 2582 h Entered Counts 2514
i Right j Analysis 228.10 Counts 1636 k Entered Counts 1630

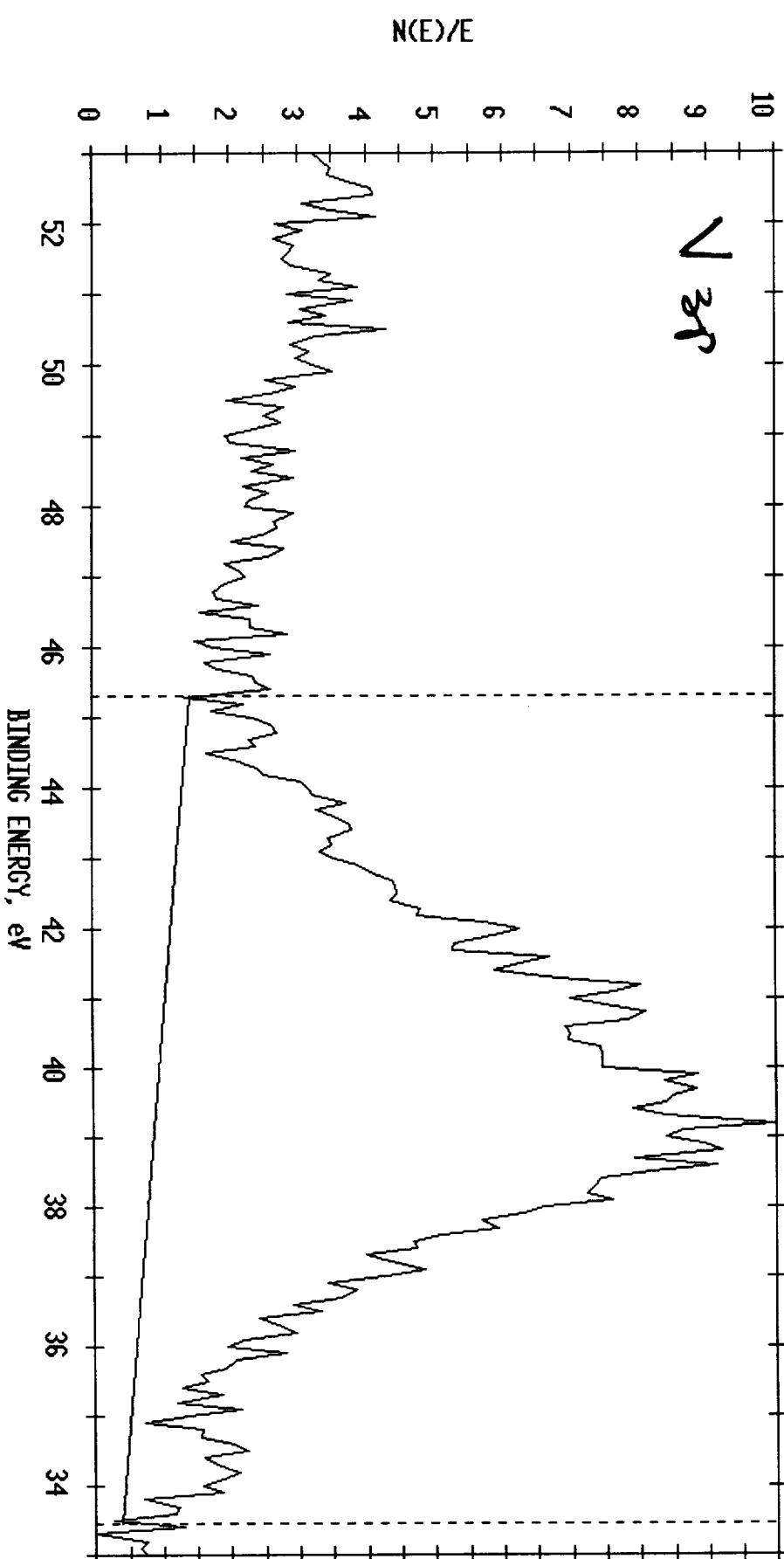
Mo 3ds

N(E)/E

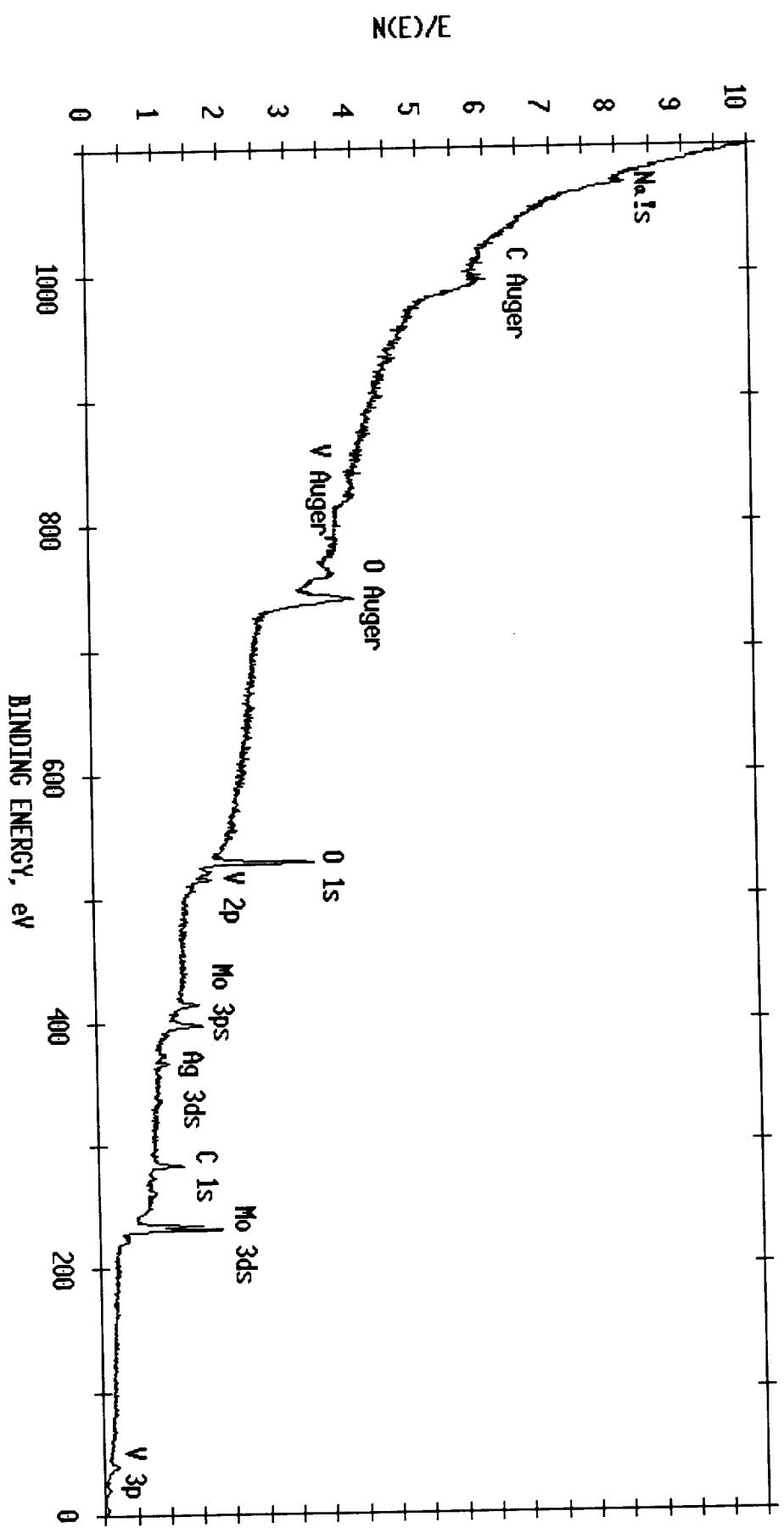


Atomic Concentration

a	User Settings	Previous	New	Entered
c	Mode Area	Height	Baseline	Counts
e	Regions	01 C1	Si1 Na1	Ag1 Mo1
f	Left	C11	Al1	V2
i	Right			
b	Element Name	■	■	■
9	Analysis	45.30	968	97
j	Analysis	33.40	Counts	Entered Counts
g			966	91
k				



ESCA SURVEY 1/27/92 ANGLE= 45 deg ACQ TIME=4.59 min
FILE: Van1_u_1 NASA, Vanadium LDEF, Unexposed Region
SCALE FACTOR= 17.195 k c/s, OFFSET= 3.296 k c/s PASS ENERGY= 89.450 eV Mg 250 μ



Print
AC Table AC Table

Exclude
Region
Atomic Concentration
Display Curve
More Softkeys
AC to AC Summary
Exit

a User Settings Previous New
c Mode Area Height d Baseline Linear Integrated
e Regions o1 c1 Sil Nal Cl1 F1 Aq1 Mol V2

b Element Name

File: Vanl_u_2
Lens: Large Area Omni-Focus
Source: Standard

Atomic Concentration Table

NASA, Vanadium LDEF, Unexposed Region

Element	Area (cts-eV/s)	Sensitivity Factor	Concentration (%)
O1s	11826	0.711	33.11
C1s	4996	0.296	33.60
Si2p	258	0.339	1.52
Na1s	1678	1.685	1.98
Cl2p	538	0.891	1.20
F1s	1300	1.000	2.59
Ag3d	3250	5.987	1.08
Mo3d	17922	3.321	10.74
V3p	1916	0.269	14.18

Ion Gun: OFF
0.5mPa

X-ray: OFF Mg

Technique: ESCA
1/28/92 9:38

a User Settings **b** Element Name

Previous

New

Entered

Entered

Mode Area Height

Baseline

Counts

Counts

Regions

Linear

V2

V2

Left

Integrated

Entered

Entered

Right

Analysis

Counts

Counts

01

Ag1

2822

2822

C1

Al1

2604

2604

Si1

Cl1

535.70

535.70

Na1

F1

2634

2634

Cl1

Mo1

2634

2634

V2

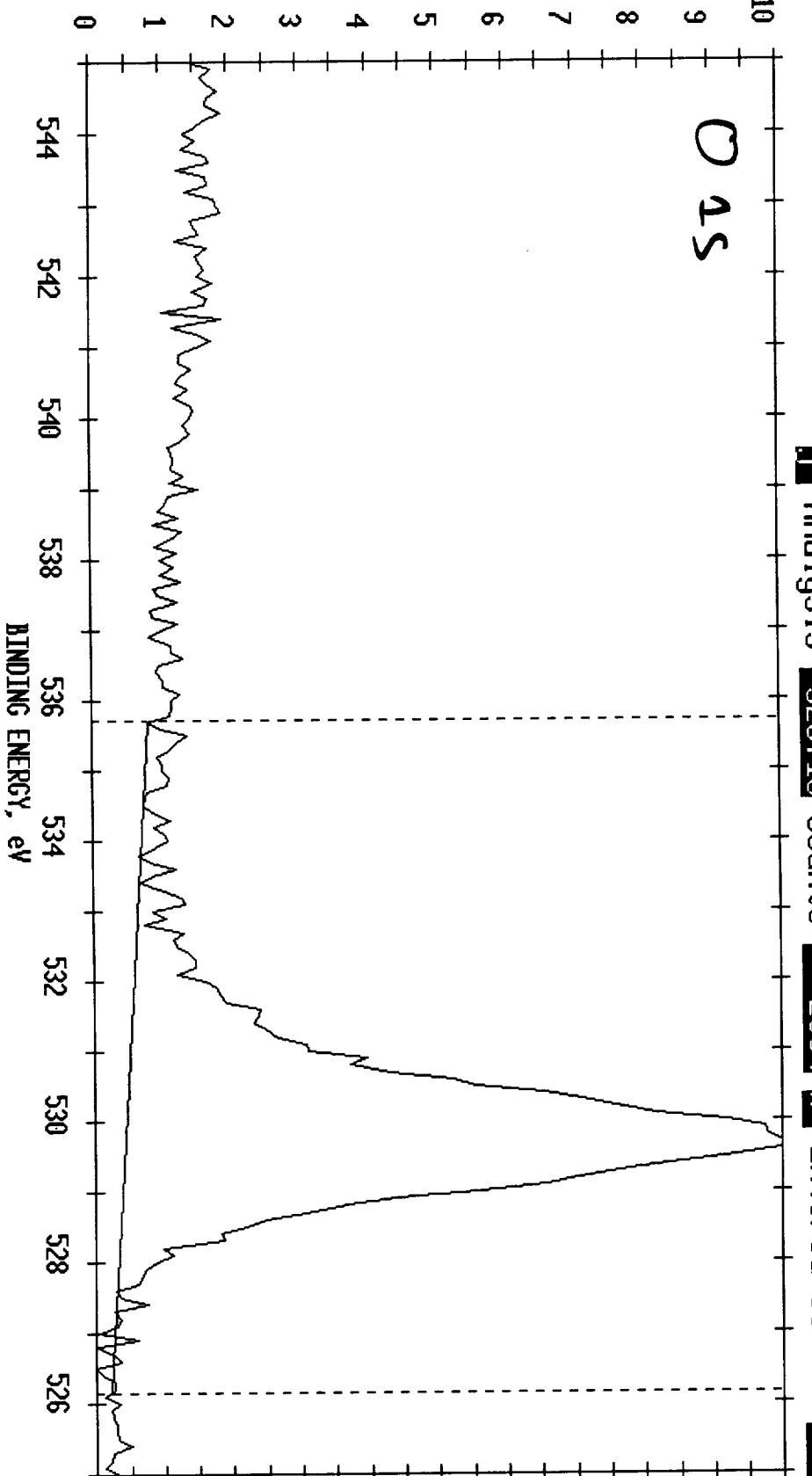
Entered

Entered

Entered

N(E)/E

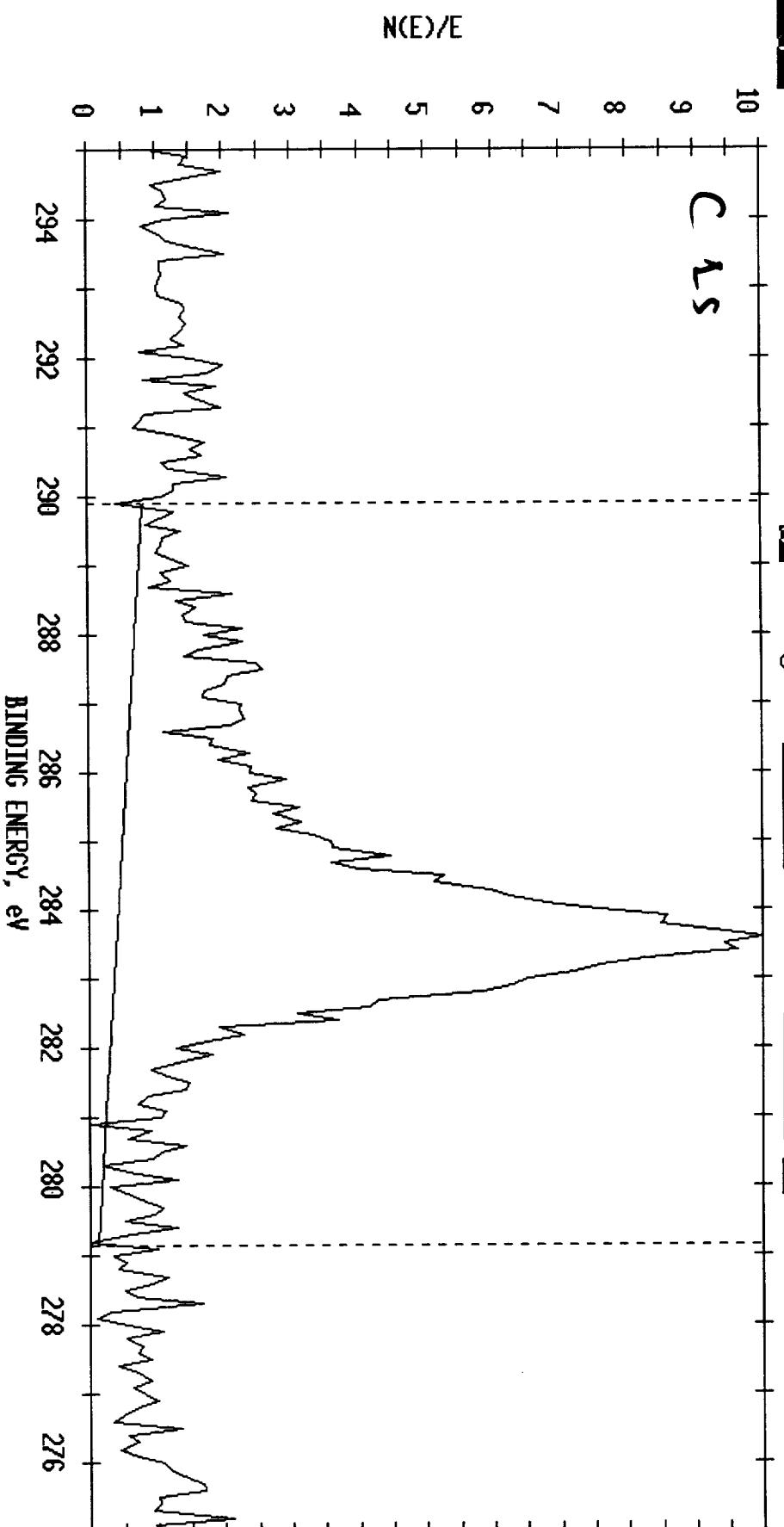
O 1s



Atomic Concentration

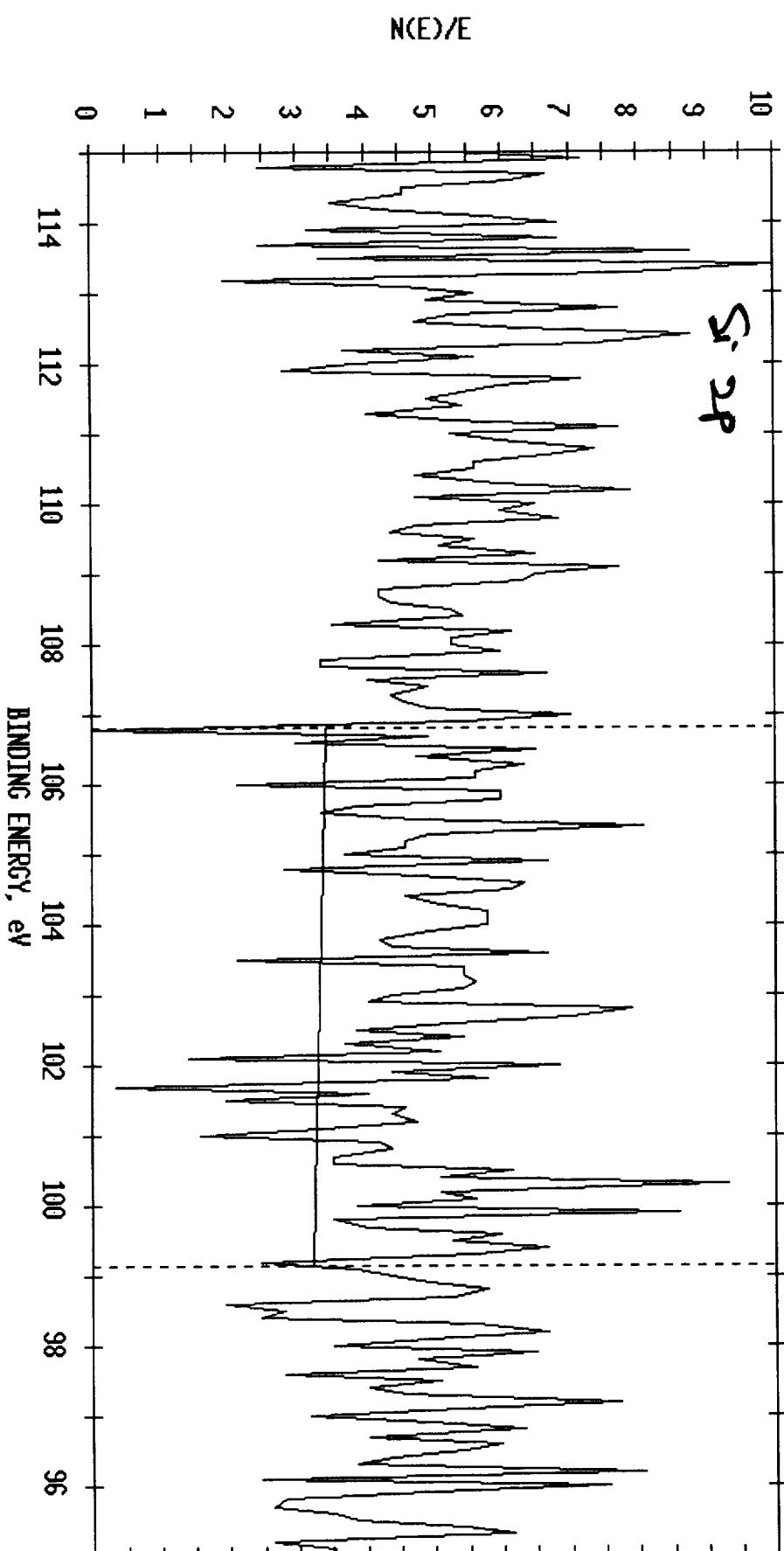
b Element Name ■

a User Settings Previous New
Mode Area Height Baseline Line Integrated
e Regions 01 C1 Si1 Na1 Cl1 F1 Ag1 Mo1 V2
f Left Right
g Analysis 289.90 Counts 1622 h Entered Counts 166
j Analysis 279.10 Counts 1684 k Entered Counts 159



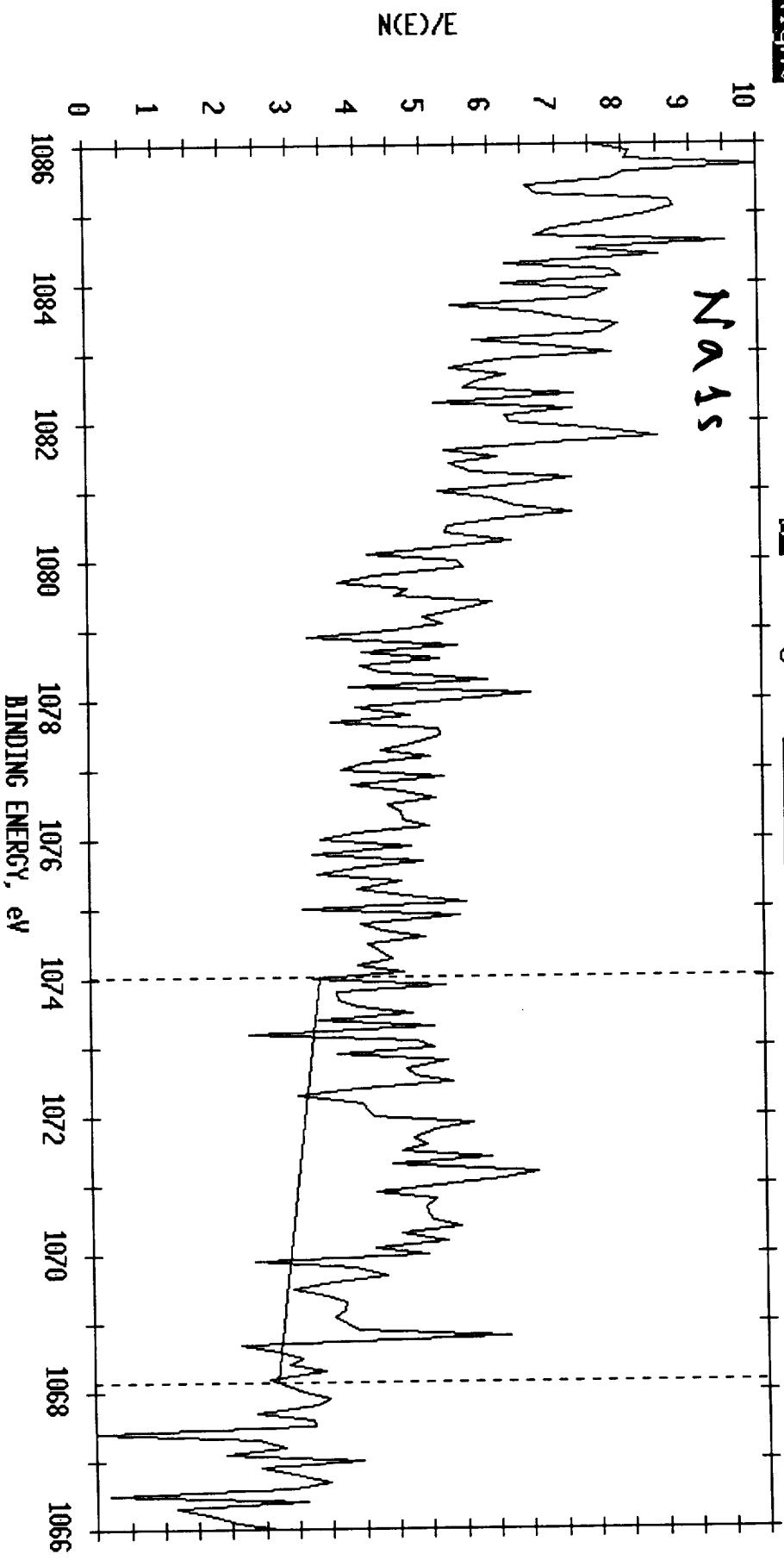
Atomic Concentration

a	User Settings	Previous	New
b	Element Name		
c	Mode	Area	Height
d	Regions	01	C1
e	Left	Si1	Na1
f	Right	C11	F1
g	Baseline	Ag1	Mo1
h	Linear	V2	Counts
i	Integrated	106.80	792
j	Analysis	99.10	836
k	Entered Counts	83	Entered Counts
v2	Counts	824	Entered Counts

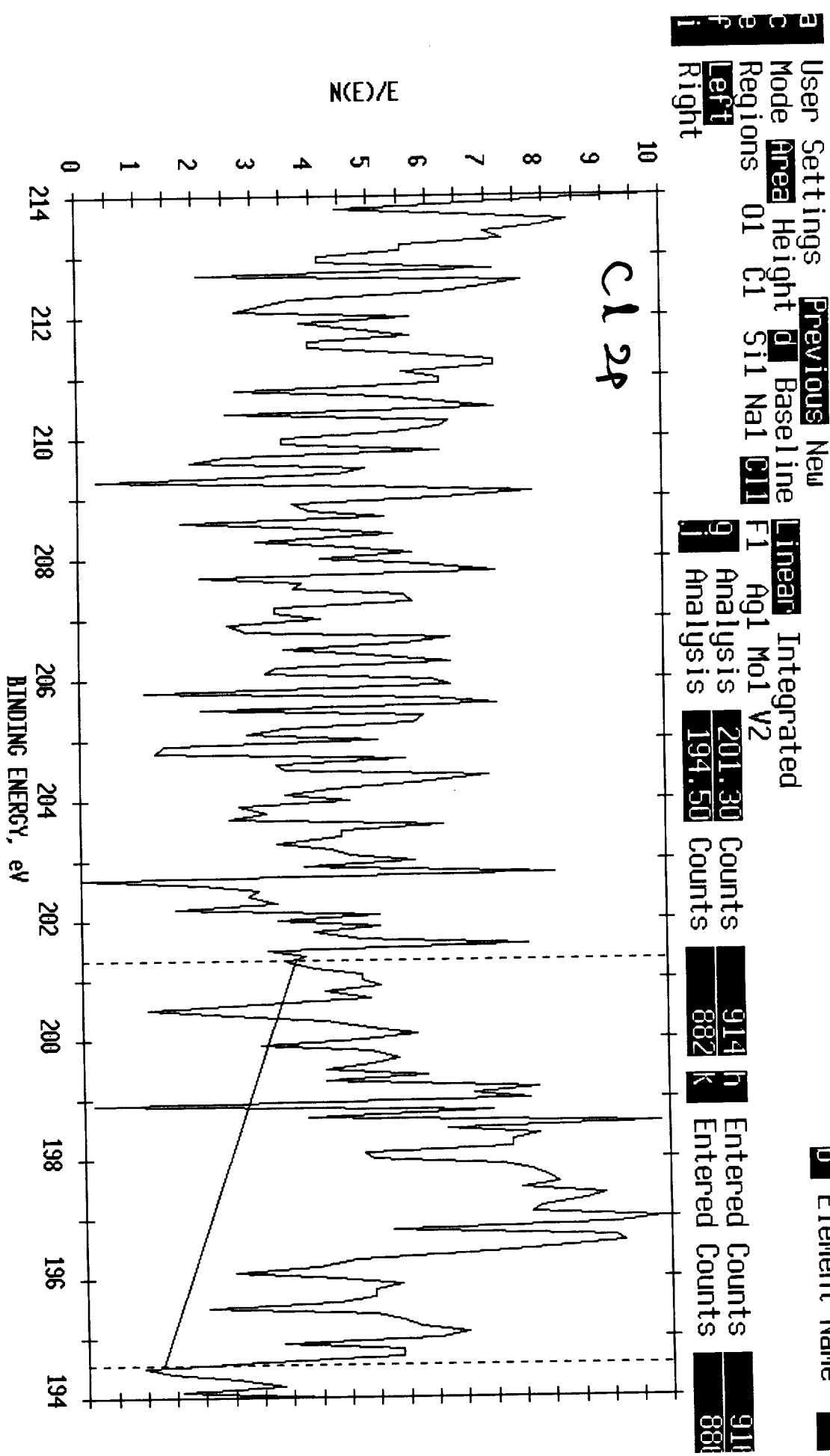


Atomic Concentration

a	User Settings	Previous	New
c	Mode Area	Height	Baseline
e	Regions	01 C1 Si1 Na1 Cl1 F1 Ag1 Mo1 V2	Linear
f	Left		Integrated
i	Right		
b	Element Name		
d	Entered Counts	7242 h	
g	Entered Counts	7259 j	
l	Entered Counts	7184 k	
m	Entered Counts	7171 l	

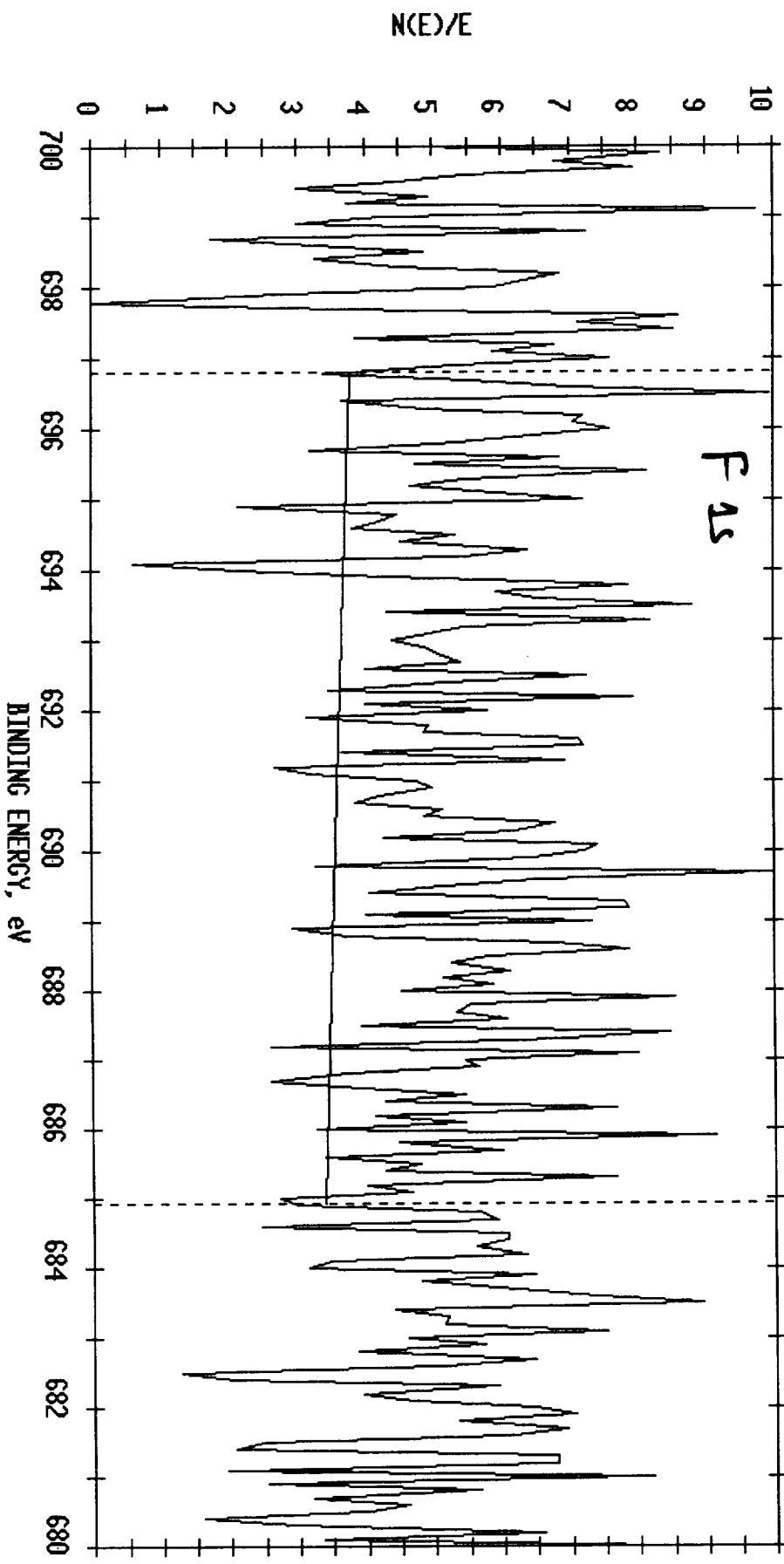


Atomic Concentration



Atomic Concentration

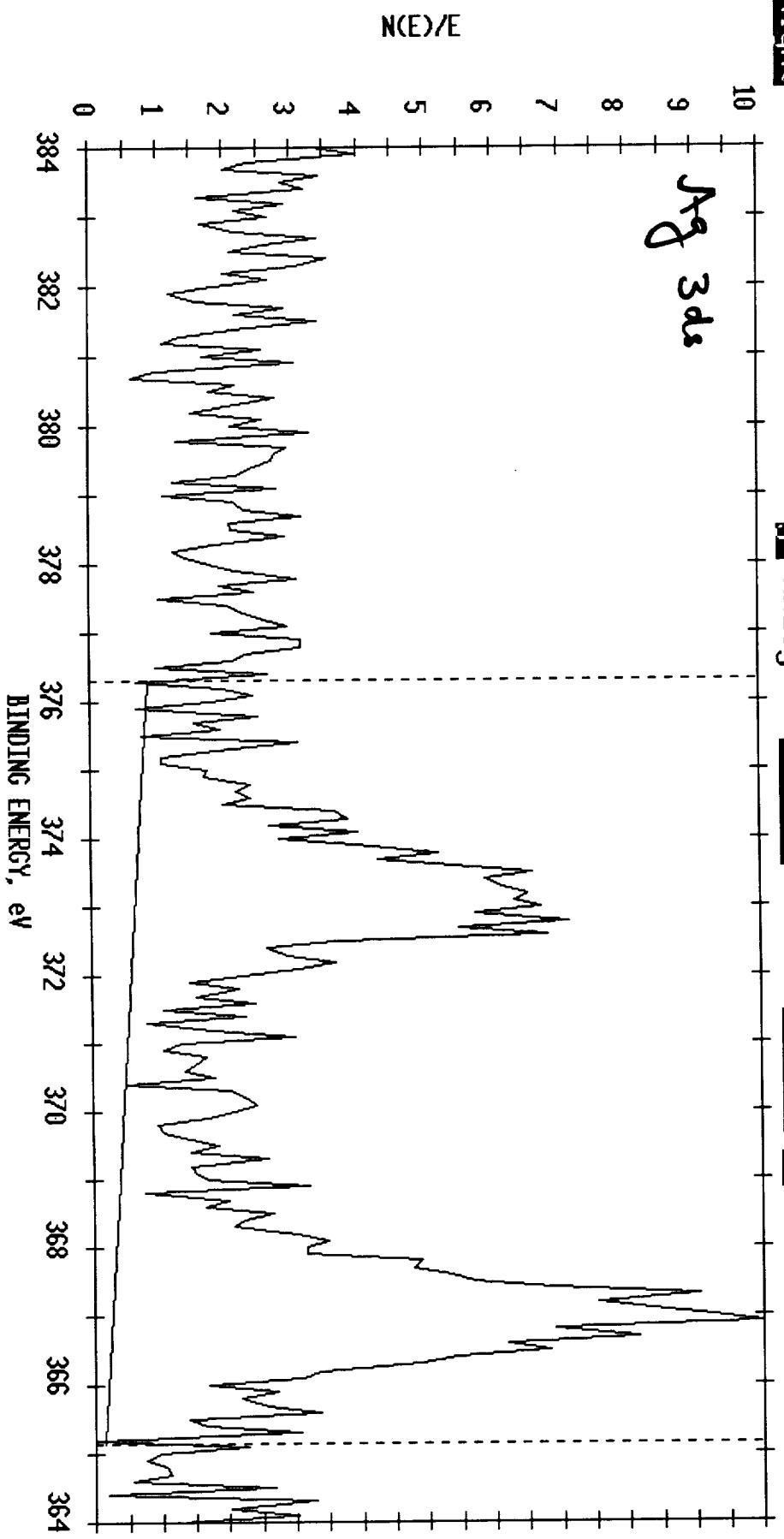
a	User Settings	Previous	New
c	Mode Area	d	Baseline
e	Regions	01	C1
f	Left	Si1	Na1
i	Right	C11	
g	F1	Ag1	Mo1
j	Analysis	696.80	Counts
k	Entered Counts	3372	h
l	Entered Counts	3384	v2
m	Entered Counts	3360	Counts
n	Entered Counts	3372	



b Element Name

Atomic Concentration

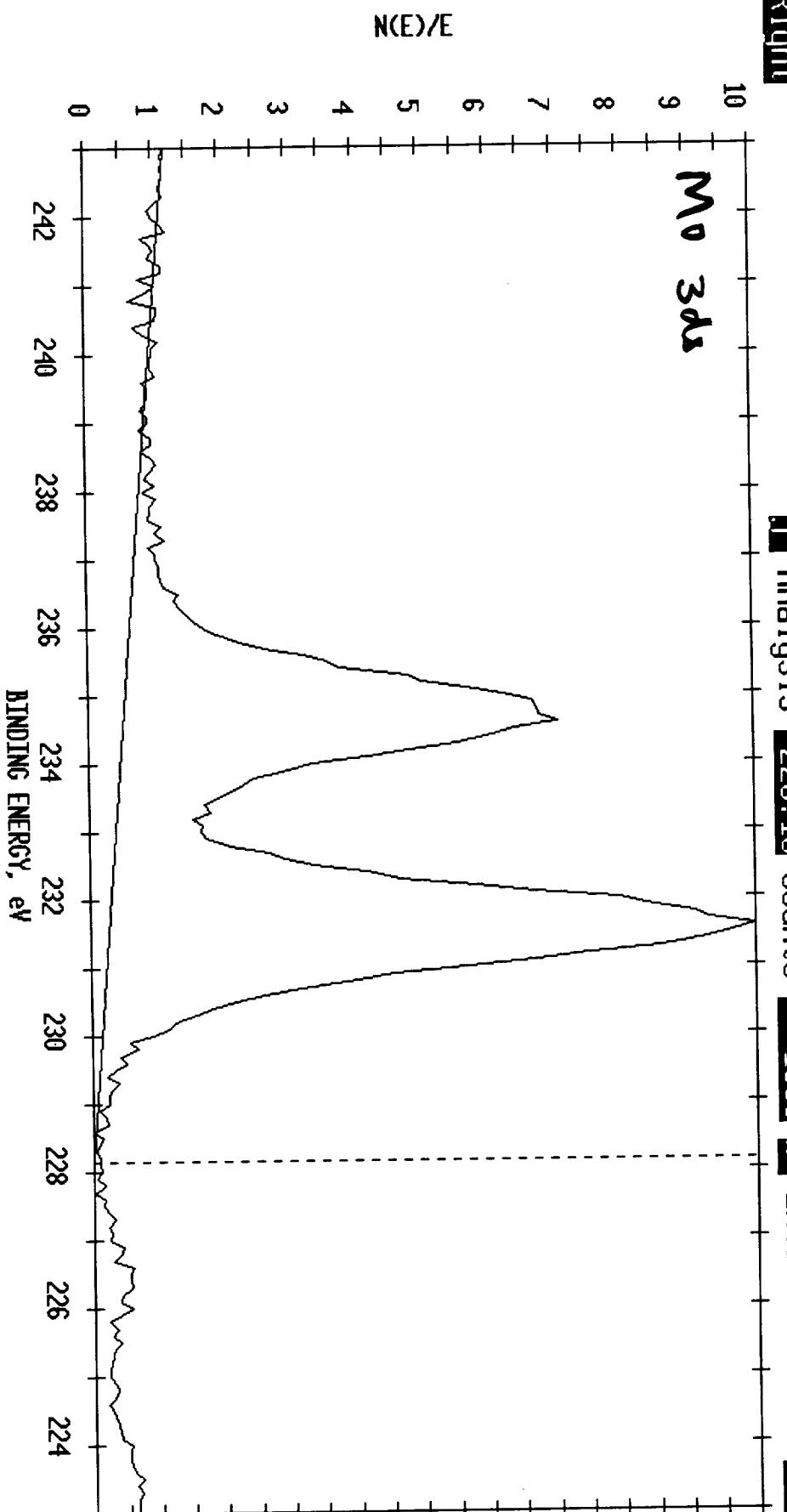
a	User Settings	Previous	New
b	Element Name		
c	Mode Area	d Baseline	e Linear
e	Regions	f C1	g Si1
f	Left	h Na1	i Cl1
i	Right	j F1	k Ag
		l Ag1	m Mo1
		n V2	
		o Analysis	p Counts
		q 376, 30	r 1766
		s 365, 10	t h Entered Counts
			u 1850
			v k Entered Counts
			w 1776
			x 1738



Atomic Concentration

b Element Name ■

a	User Settings	Previous	New
c	Mode Area	d Baseline	Linear
e	Regions	01 C1	Si1 Na1 C11
f	Left	F1 Ag1	Mg1 V2
i	Right	g Analysis	h Entered Counts 243.00 i Analysis 228.10
j		k Entered Counts 1450 l Entered Counts 1050	m Entered Counts 1438 n Entered Counts 1019



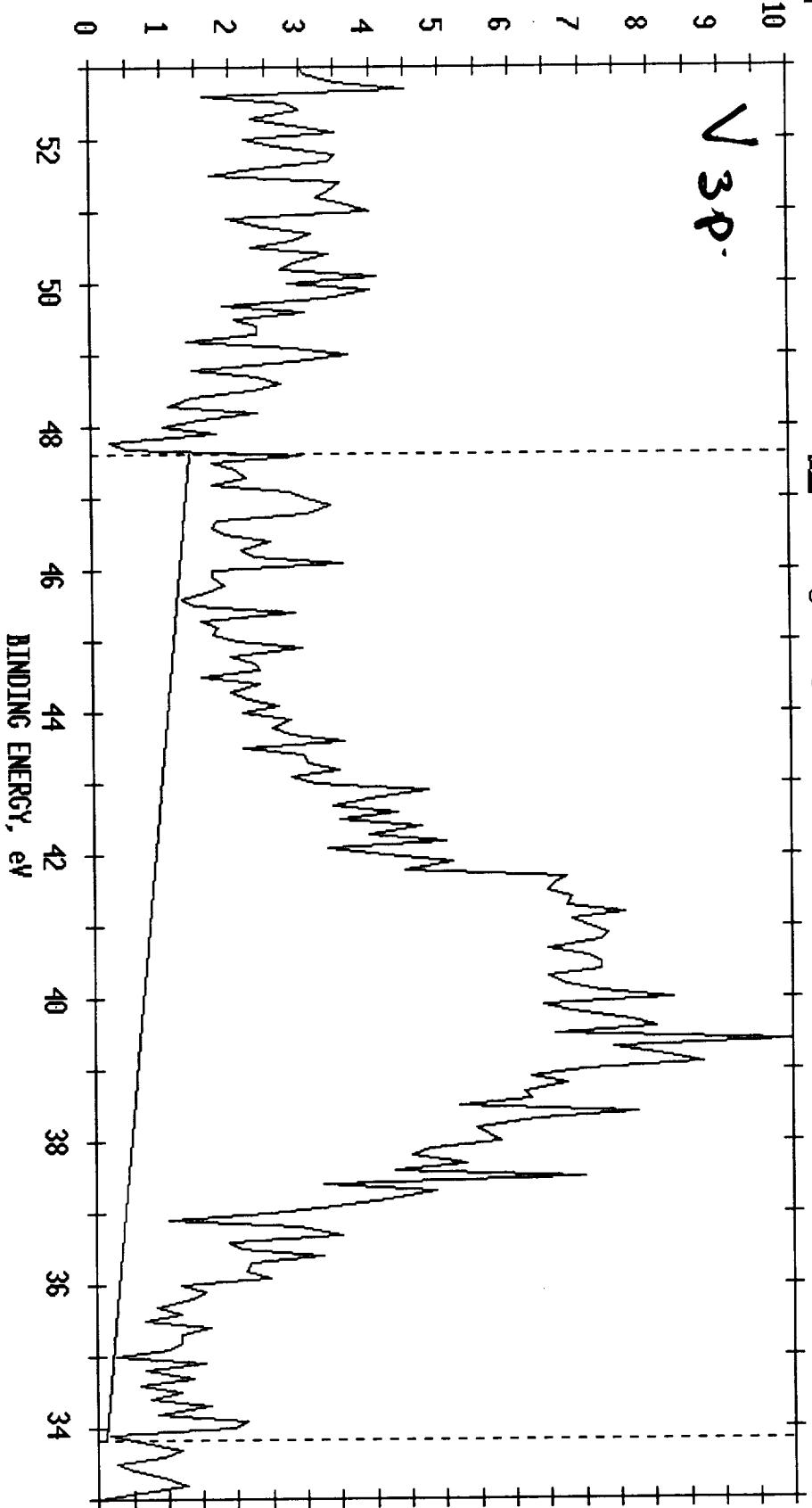
Atomic Concentration

b Element Name

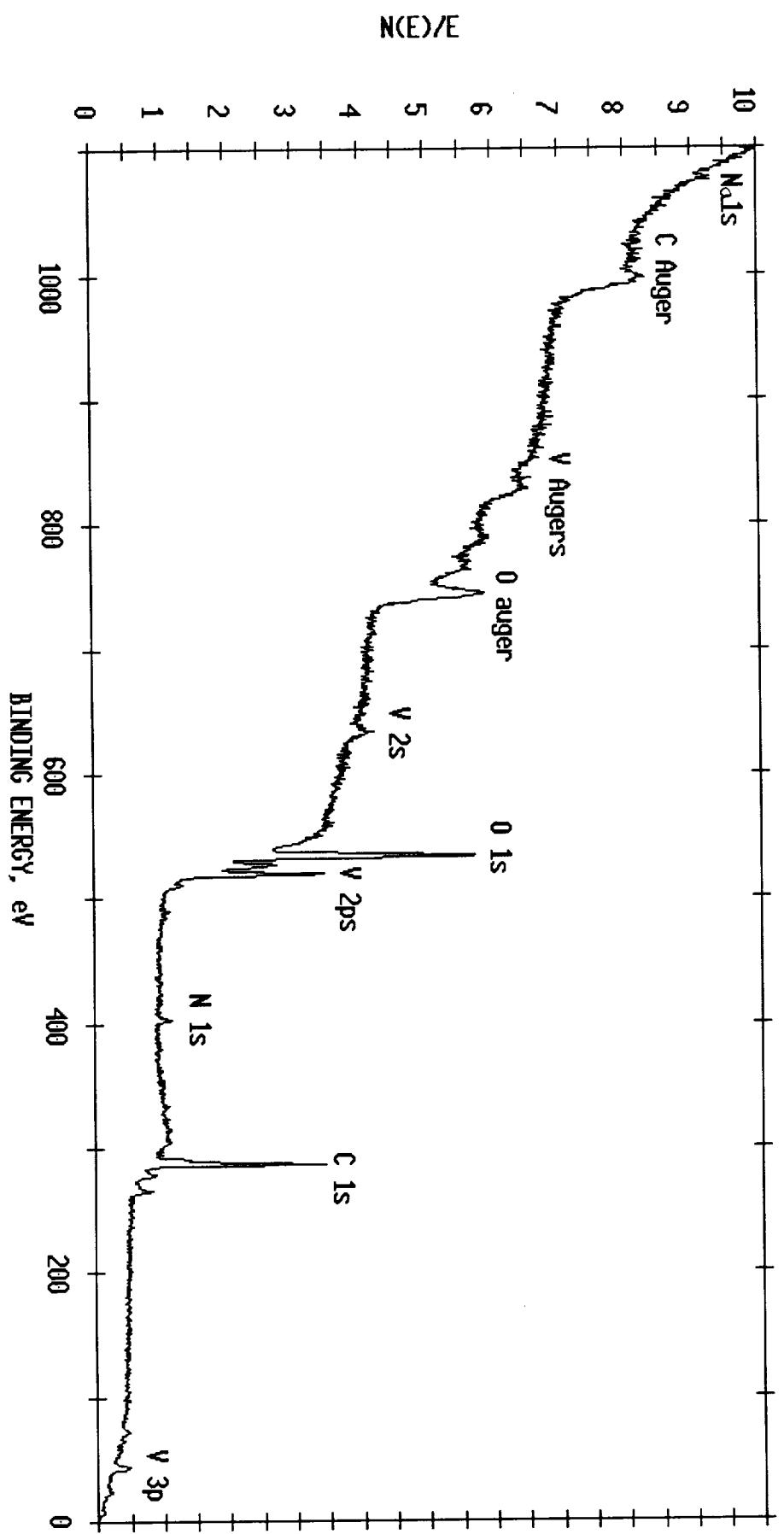
a	User Settings	Previous	New
c	Mode Area	Height d	Baseline
e	Regions	01 C1 Si1 Na1 Cl1	Linear
f	Left	F1 Ag1 Mo1 V2	Integrated
i	Right	9 Analysis	Entered Counts
j		33.80	Counts
k		780	h
		724	Entered Counts
		741	Entered Counts
		713	Entered Counts

N(E)/E

$\sqrt{3} \rho$



ESCA SURVEY 1/28/92 ANGLE= 45 deg ACQ TIME=4.59 min
FILE: Van2_1 NMSA, Backside of Vanadium LDEF sample, Ref only
SCALE FACTOR= 17.814 k c/s, OFFSET= 3.200 k c/s PASS ENERGY= 89.450 eV Mg 250 W



AC Table	Print	Exclude	Display	More	AC to AC	Exit
	AC Table	Region	Curve	Softkeys	Summary	
a User Settings	Previous	New				
c Mode Area Height	d Baseline	Linear	Integrated			
e Regions	O1 C1 Sil Nai C11 N1 F1 V1					

File: Van2_2
 Lens: Large Area Omni-Focus
 NASA, Backside of Vanadium LDEF sample, Ref only
 Source: Standard

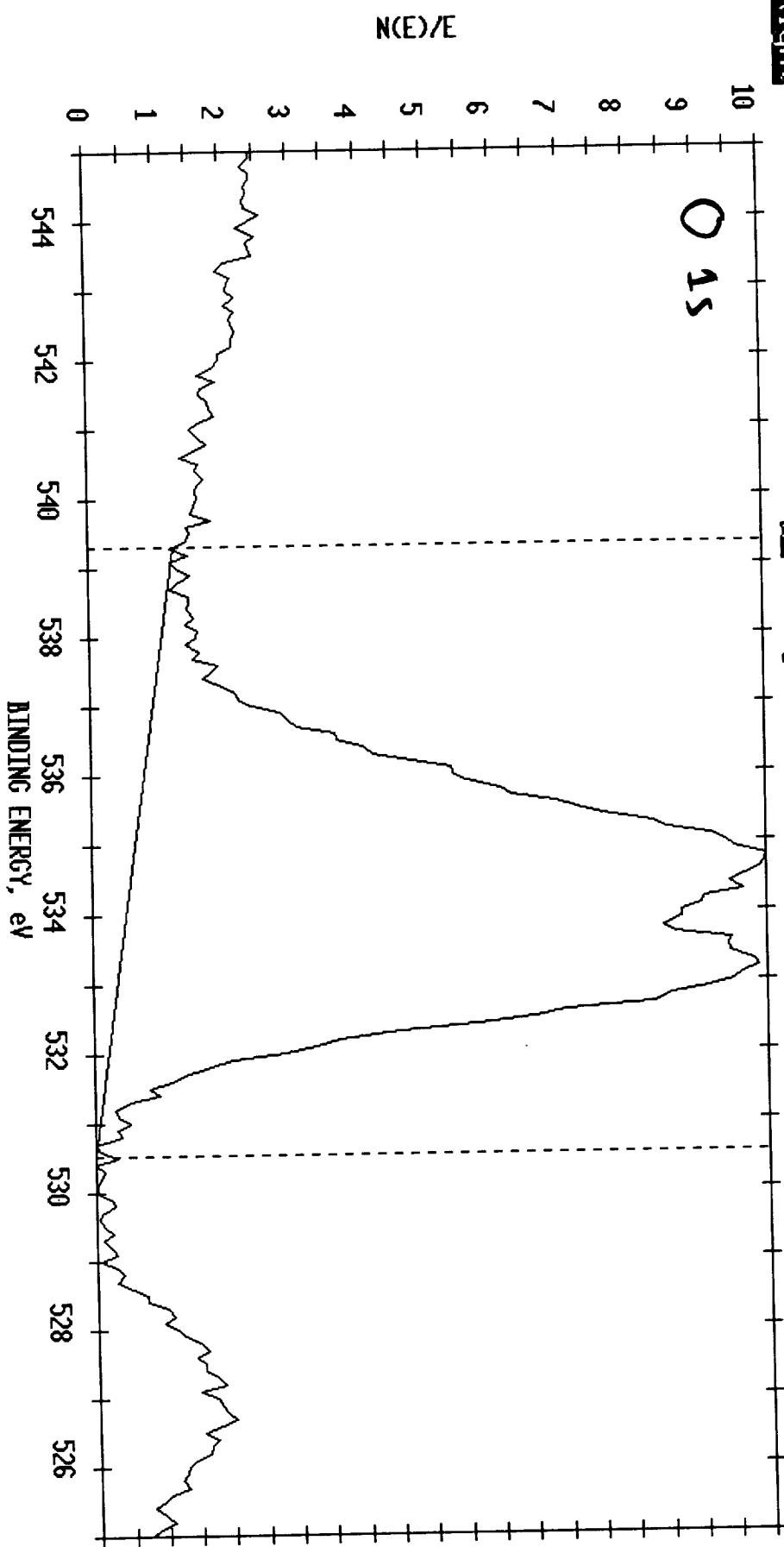
Element	Area (cts-eV/s)	Sensitivity Factor	Concentration (%)
O1s	28910	0.711	34.02
C1s	17556	0.296	49.62
Si2p	622	0.339	1.54
Nals	2100	1.685	1.04
Cl2p	892	0.891	0.84
N1s	2132	0.477	3.74
F1s	702	1.000	0.59
V2p	21782	2.116	8.61

Ion Gun: OFF
 X-ray: OFF Mg
 0.5mPa

Technique: ESCA
 1/28/92 14:40

a Atomic Concentration

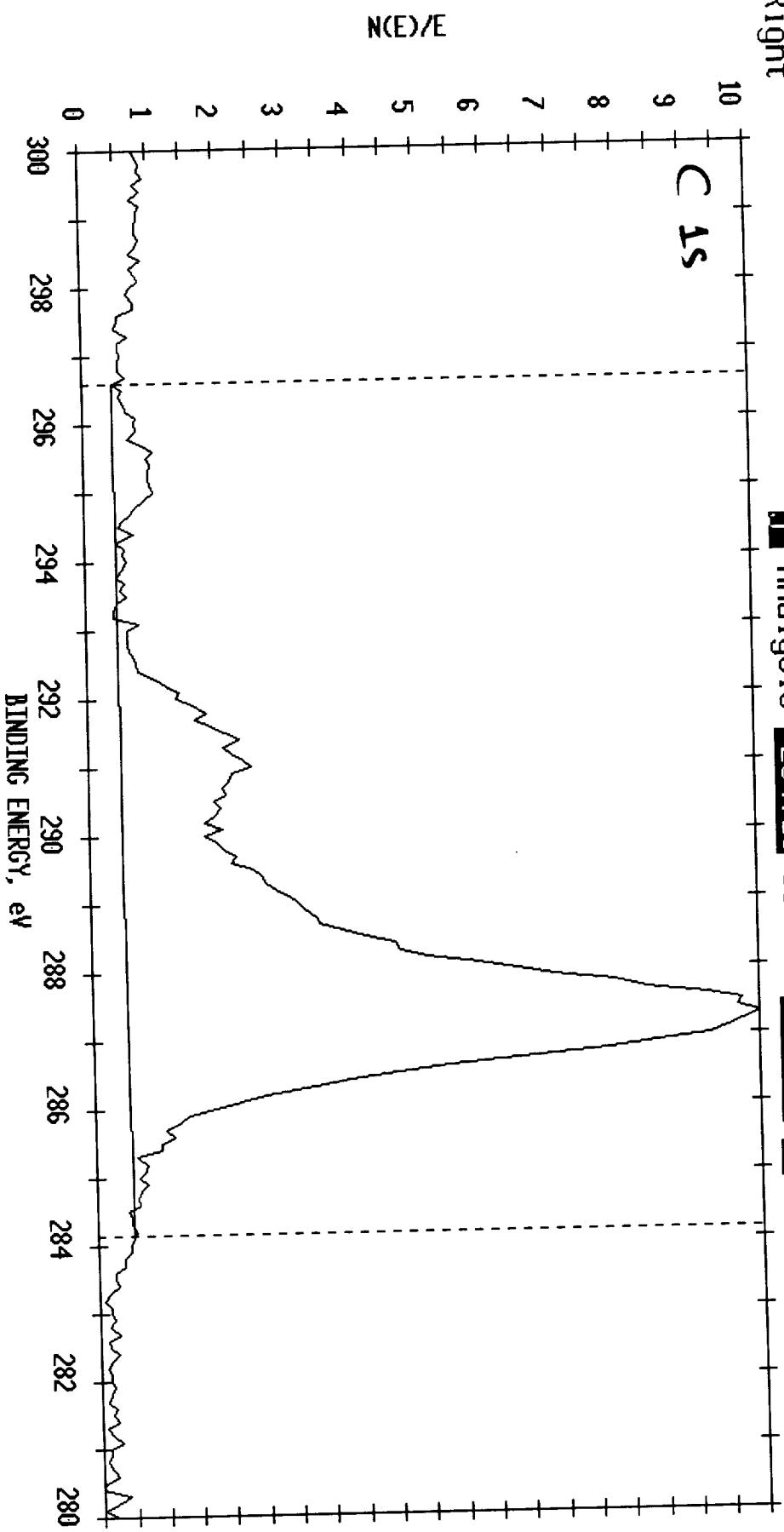
User Settings	Previous	New
Mode Area	d Baseline	Linear
Regions	01 C1 Si1 Na1 Cl1 N1 F1 V1	9 Analysis
Left	539.30 Counts	3098 h Entered Counts
Right	530.50 Counts	2734 k Entered Counts
		3110
		2606



Atomic Concentration

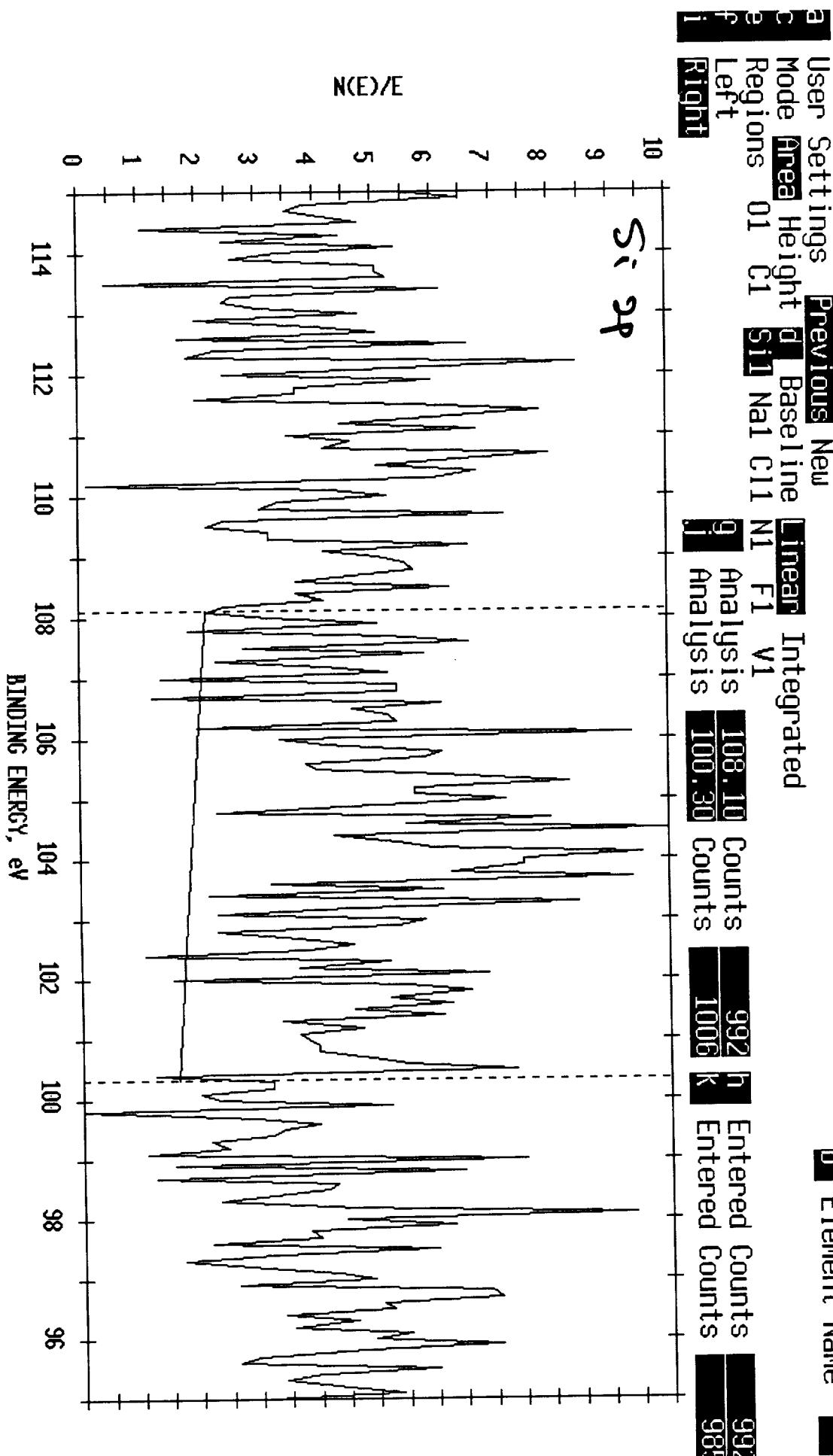
b Element Name ■

a User Settings	Previous	New
c Mode Area	d Baseline	Linear
e Regions	01 C1	Si1 Na1 Cl1 N1 F1 V1
f Left	g Analysis	296.60 Counts 1418 h Entered Counts 141
i Right	Analysis	284.10 Counts 1456 k Entered Counts 145



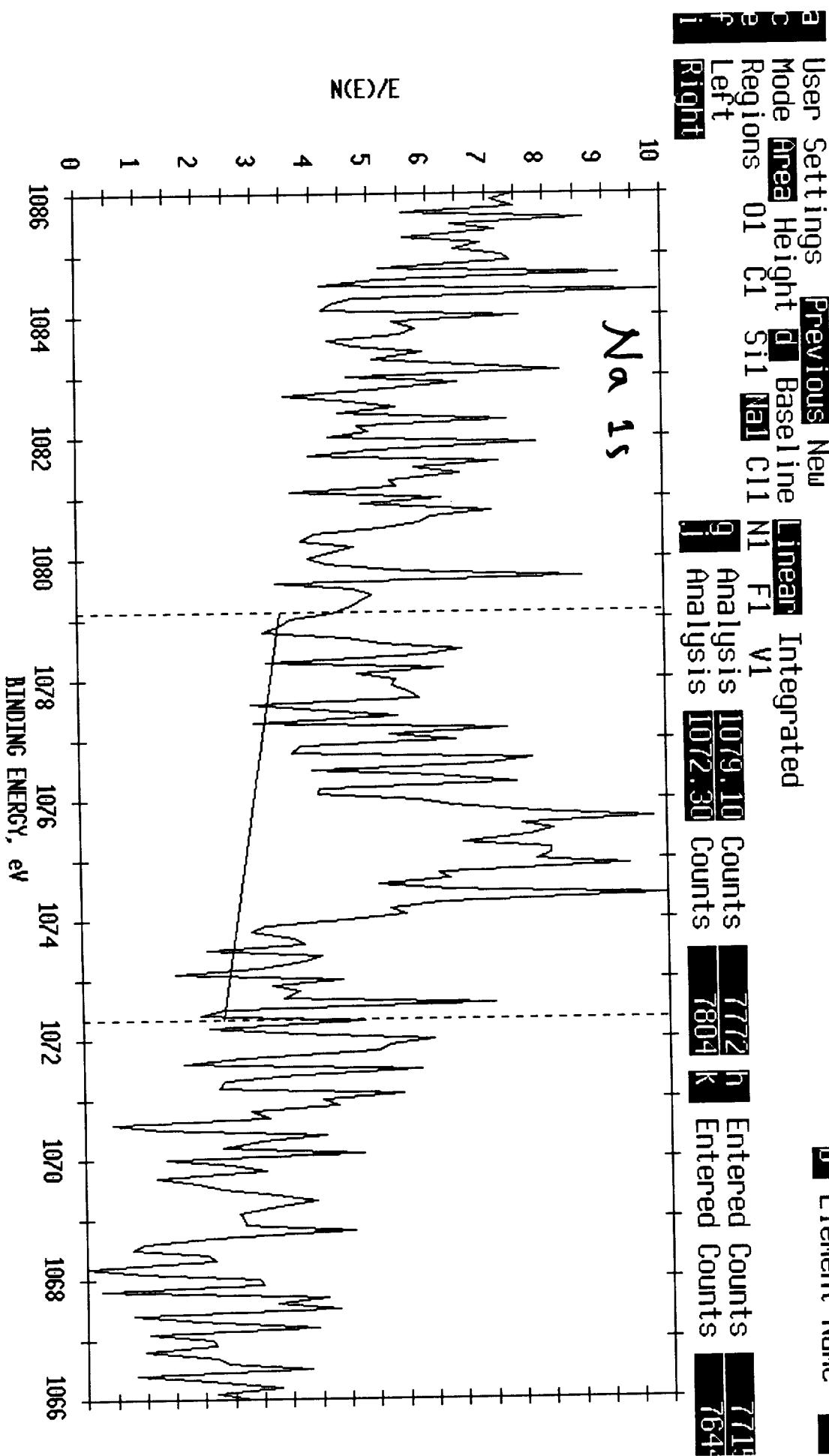
Atomic Concentration

b Element Name



Atomic Concentration

b Element Name



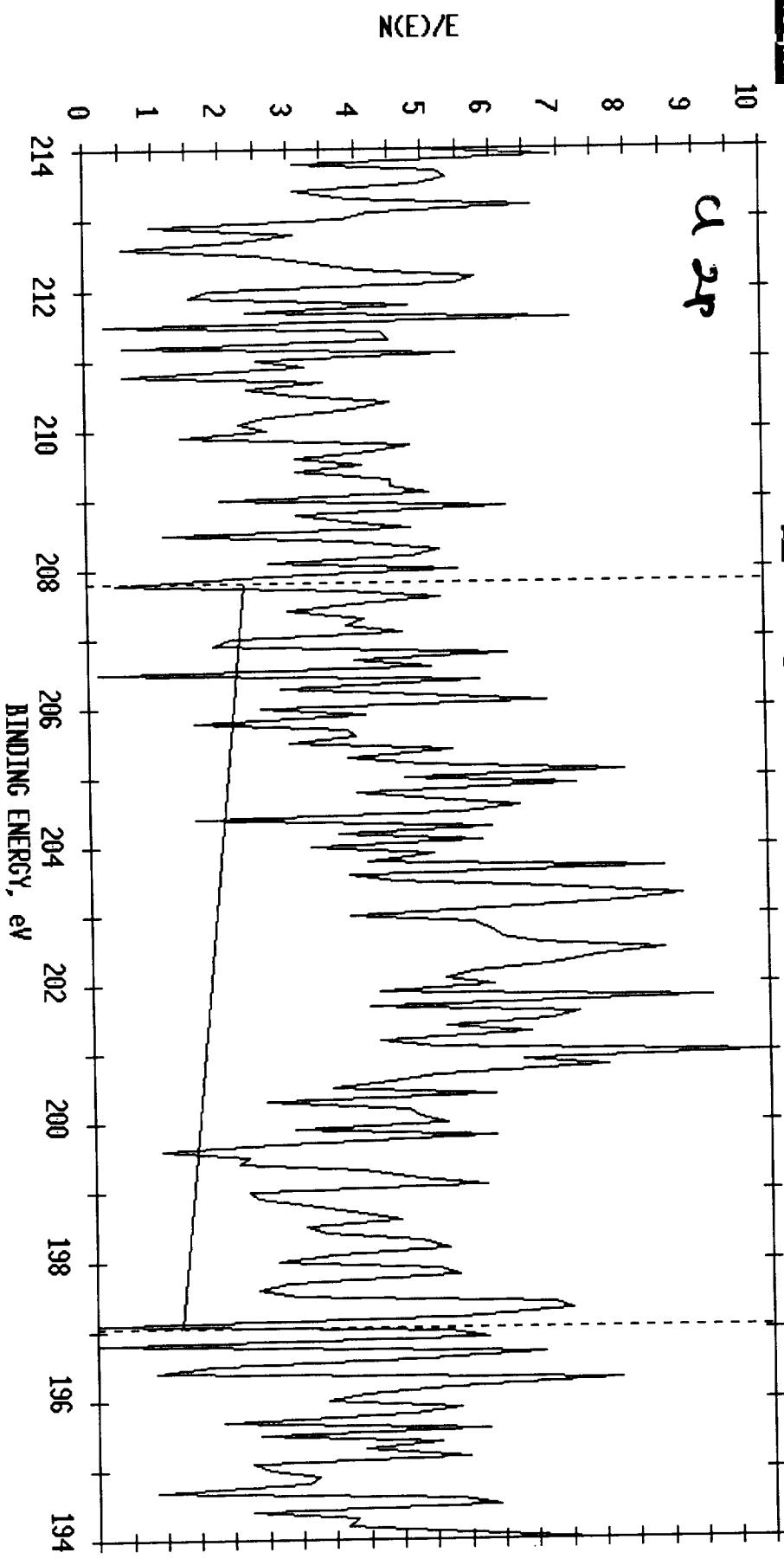
Atomic Concentration

b Element Name

a User Settings
Mode Area Height d Baseline
Regions 01 C1 Si1 Na1 Cl1 N1
Left f Right g Analysis
i Analysis

Previous New
Linear Integrated

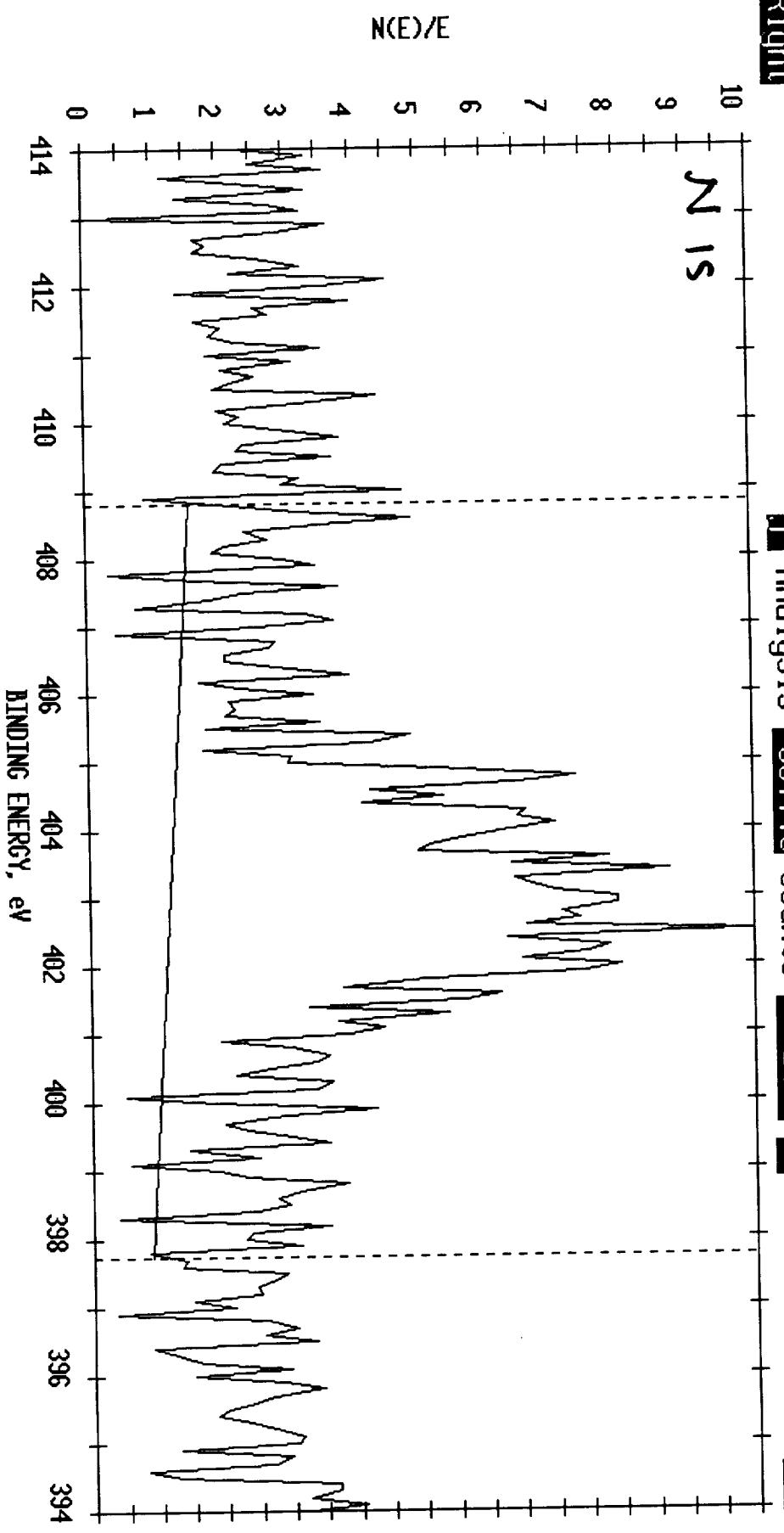
Counts Entered Counts
207.80 1014 h
197.00 1082 k
Entered Counts
104 l
1024 m



Atomic Concentration

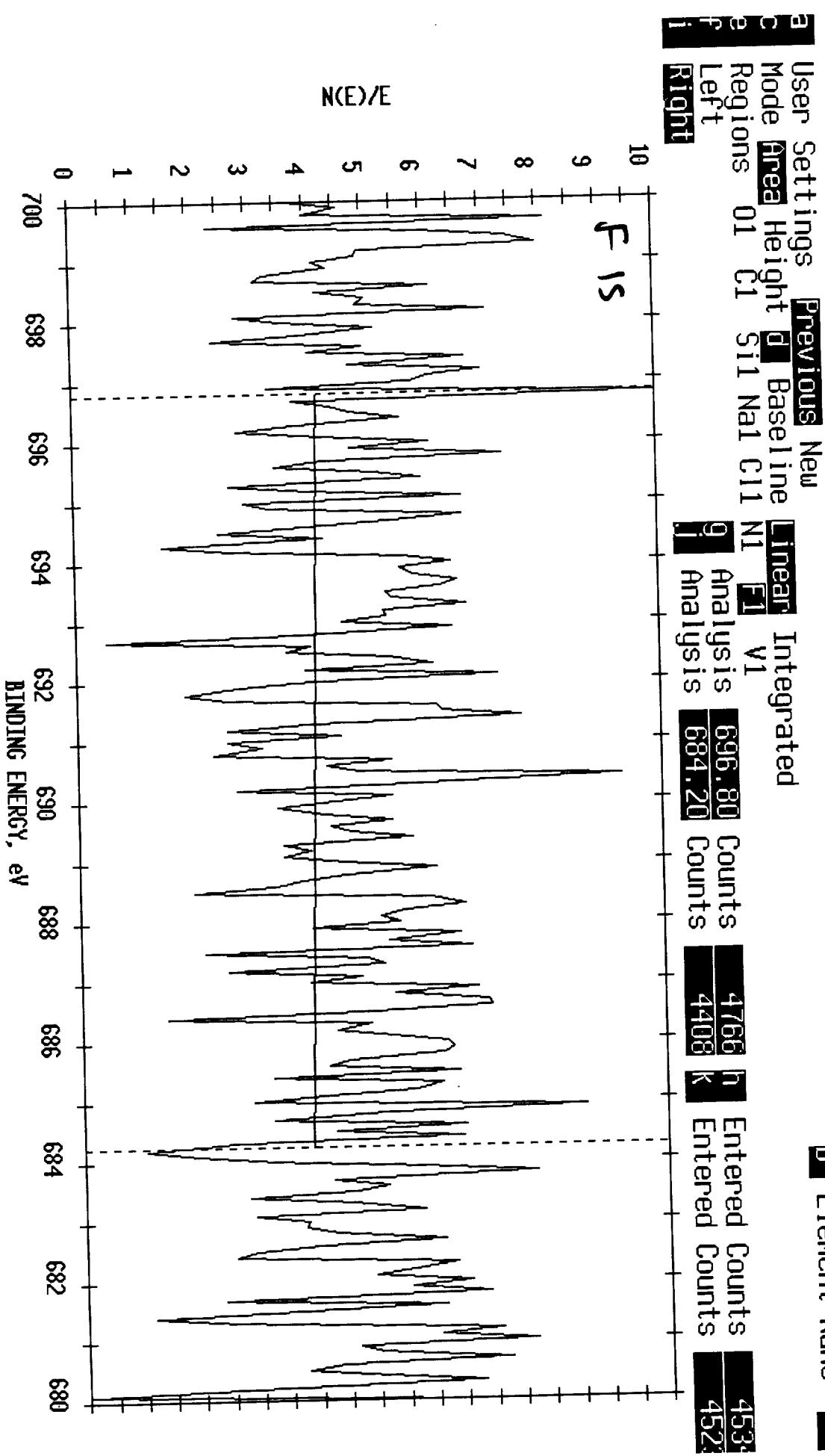
b Element Name █

a	User Settings	Previous	New
c	Mode	Area	Baseline
e	Regions	01	C1 Si1 Na1 C11
f	Left	N1	F1
i	Right	V1	
g	Analysis	408.80	Counts
j	Analysis	397.70	Counts
h	Entered Counts	1484	1460
k	Entered Counts	1454	1430



Atomic Concentration

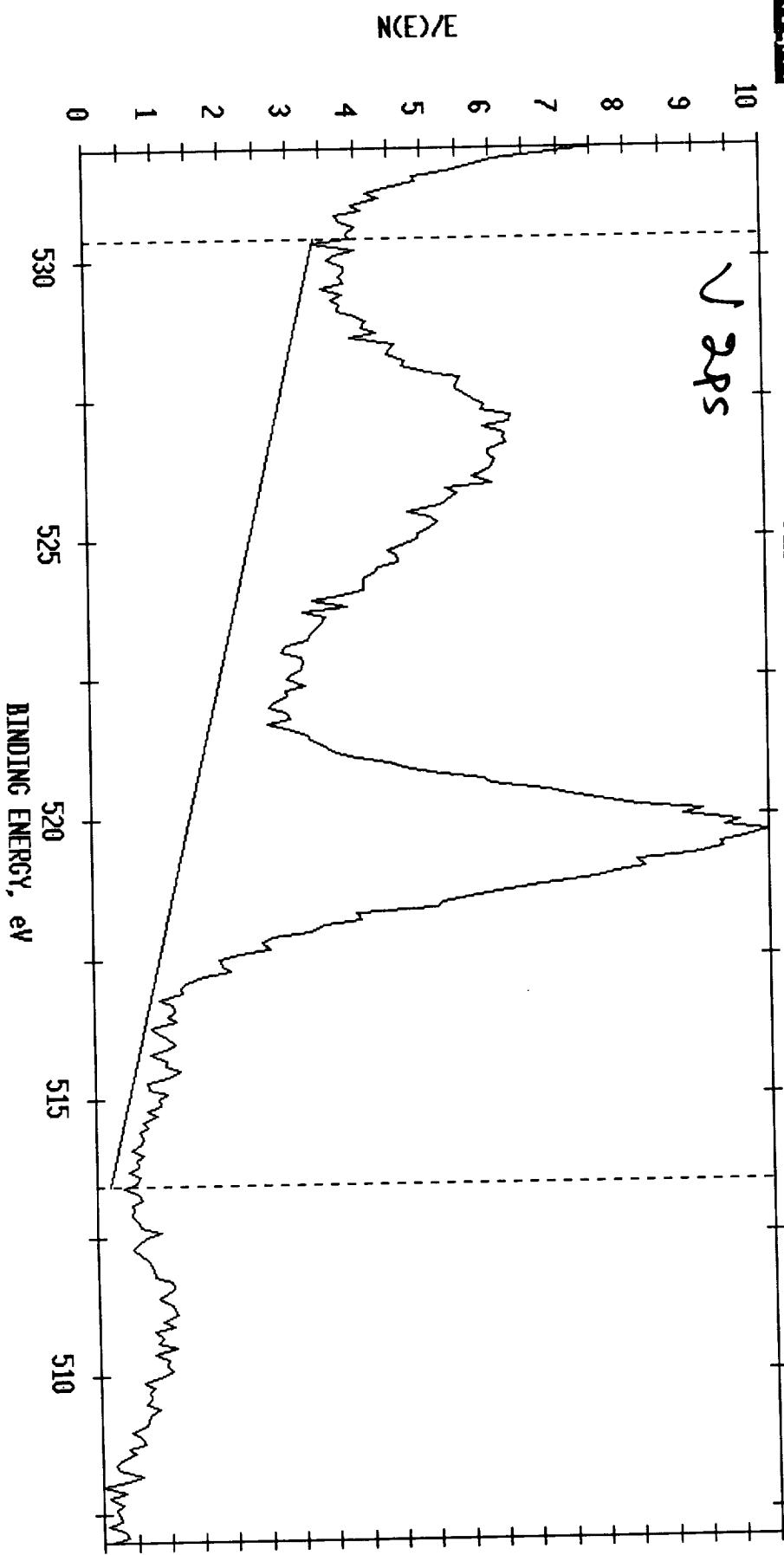
b Element Name



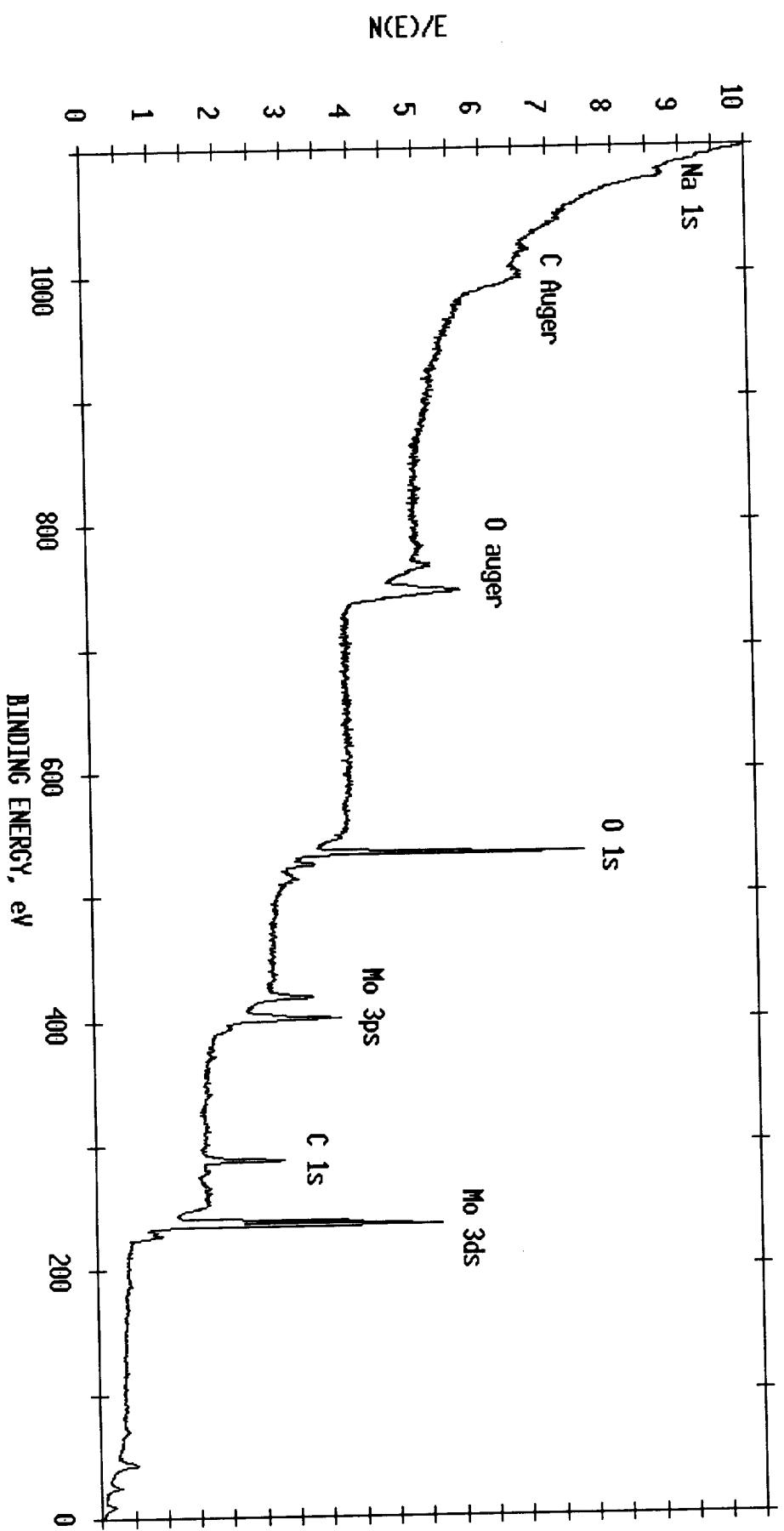
Atomic Concentration

b Element Name

a	User Settings	Previous	New
c	Mode Area	Baseline	Linear
e	Regions	01 C1	C11 N1
f	Left	F1	V1
i	Right		
		Analysis	Analysis
		530.40 Counts	2744 h Entered Counts
		513.40 Counts	1686 k Entered Counts
			2594 162



ESCA SURVEY 1/23/92 ANGLE= 45 deg ACQ TIME=4.59 min
FILE: Rh1_x_1 NASA, Rhodium LDEF, Exposed Region
SCALE FACTOR= 35.136 k c/s, OFFSET= 6.496 k c/s PASS ENERGY= 89.450 eV Mg 250 W



Print
AC Table AC Table

Exclude
Region
Atomic Concentration
Display Curve
More Softkeys
AC to AC Summary
Exit

a User Settings Previous New
c Mode Area Height d Baseline Linear Integrated
e Regions O1 C1 Si1 Na1 Cl1 F1 Ag1 Mo1 Rh1

Atomic Concentration Table

File: Rh1_x_2
Lens: Large Area Omni-Focus
Source: NASA, Rhodium LDEF, Exposed Region
Standard

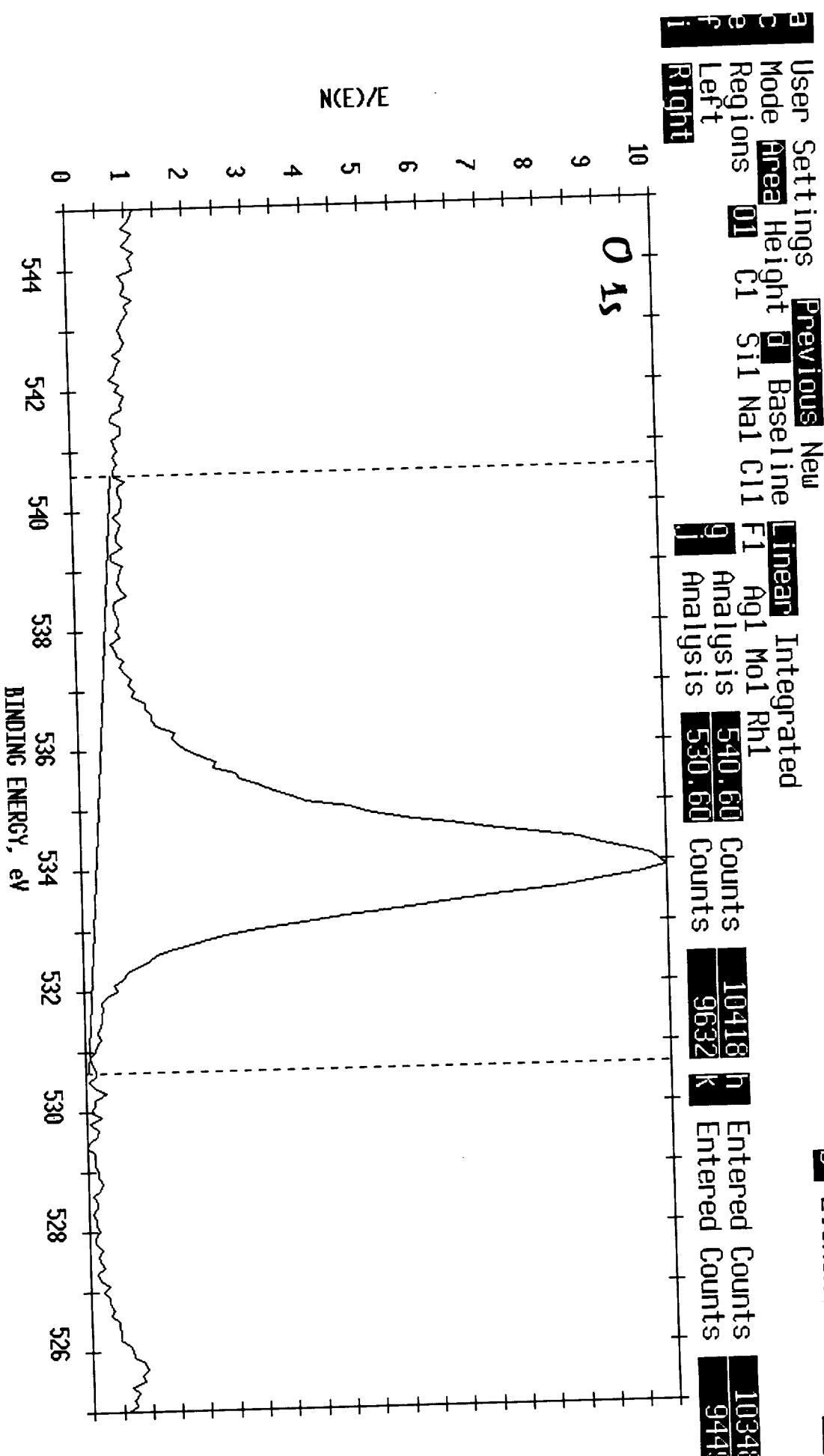
Element	Area (cts-eV/s)	sensitivity Factor	concentration (%)
O1s	55524	0.711	41.63
C1s	22134	0.296	39.86
Si2p	420	0.339	0.66
Na1s	3180	1.685	1.01
C12p	756	0.891	0.45
F1s	1182	1.000	0.63
Ag3d	3100	5.987	0.28
Mo3d	85538	3.321	13.73
Rh3d	15806	4.822	1.75

Ion Gun: OFF X-ray: ON Mg
0.5mPa

Acquiring Technique: ESCA
1/28/92 10:49

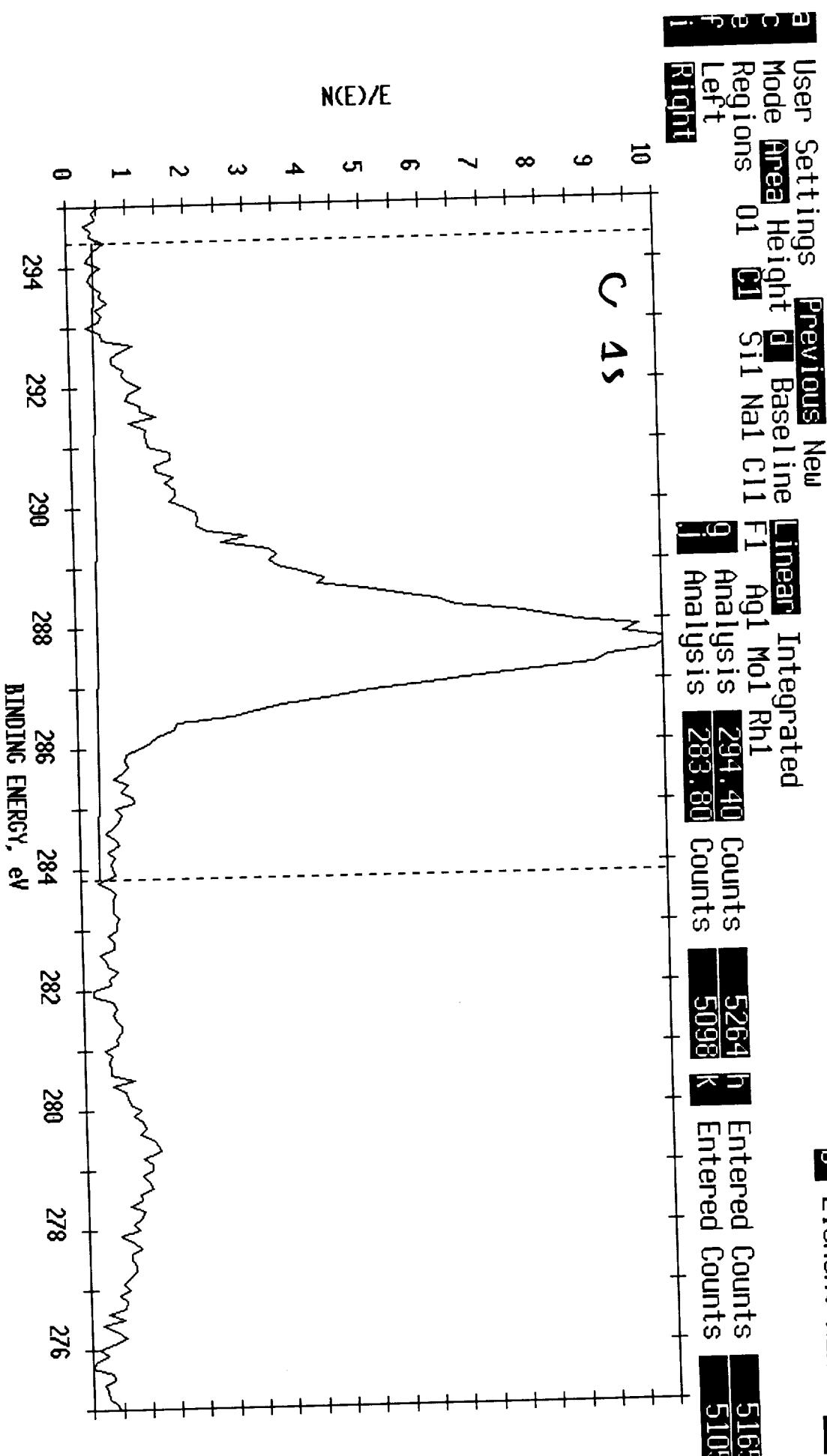
Atomic Concentration

b Element Name ■



Atomic Concentration

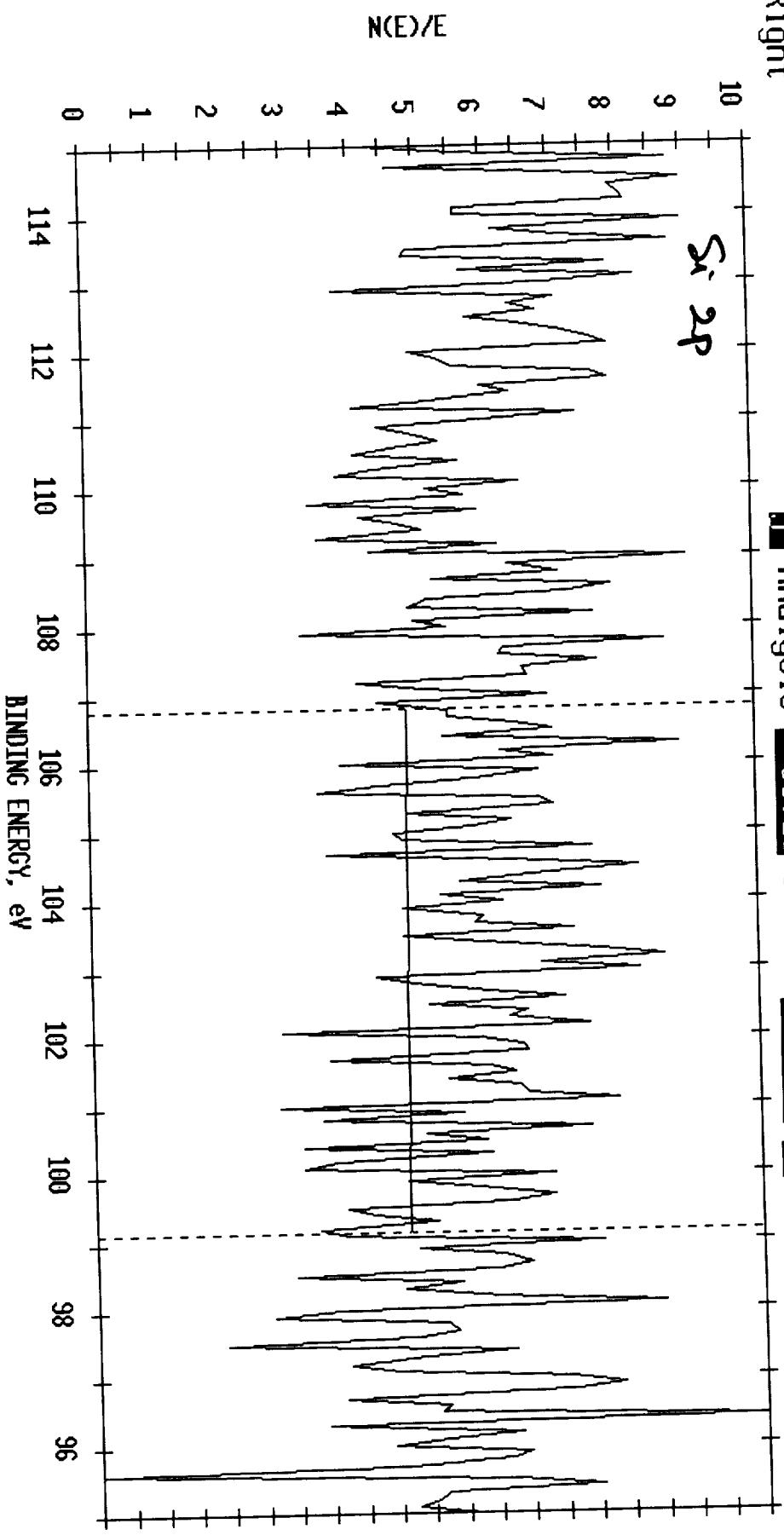
b Element Name ■



Atomic Concentration

b Element Name

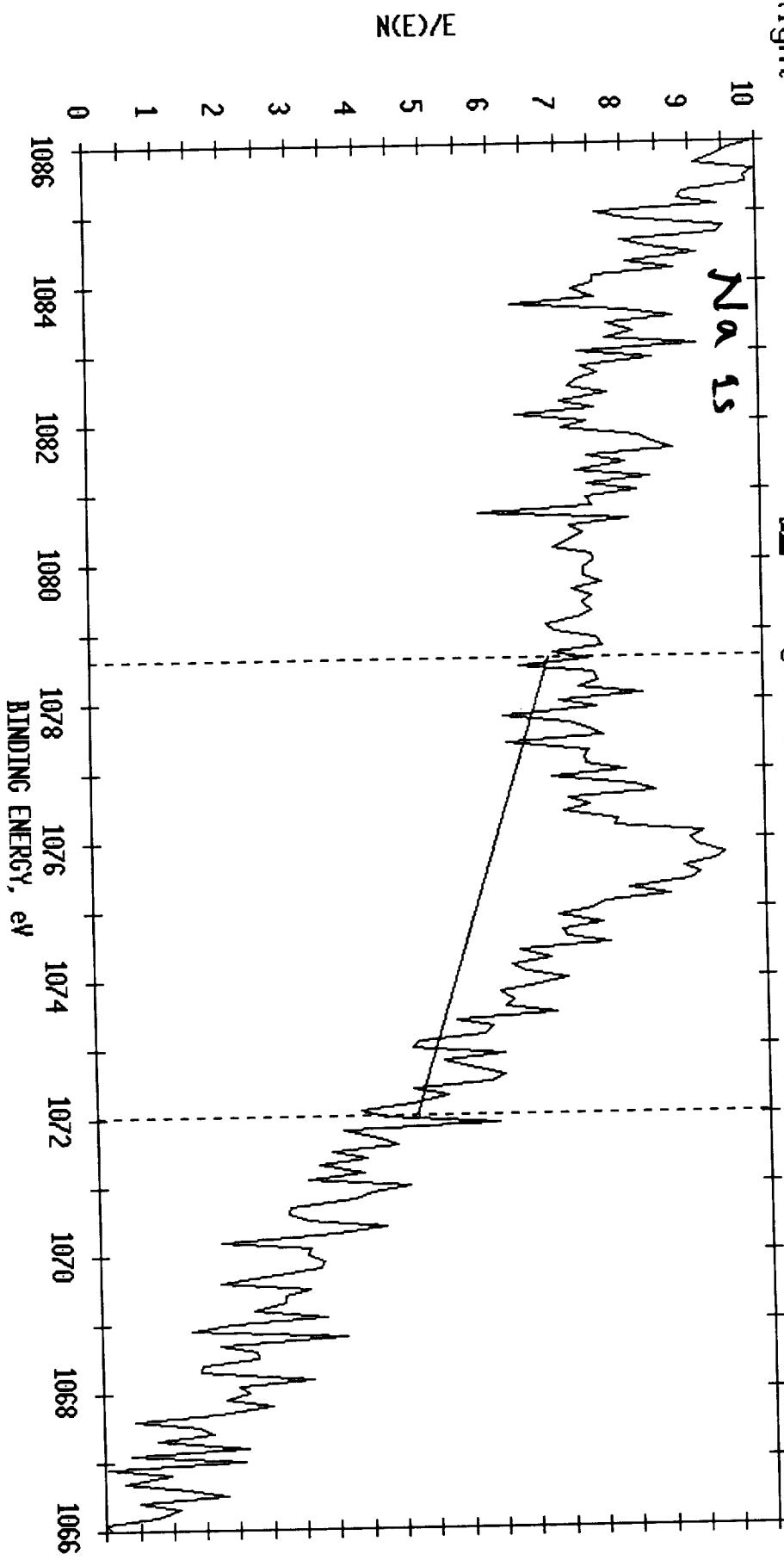
a	User Settings	Previous	New
c	Mode	Height	Baseline
e	Regions	01	Linear
f	Left	C1	F1
i	Right	Si1	Ag1
j		Na1	Mo1
g		C11	Rh1
h	Analysis	106.80	Counts
k	Analysis	99.10	Counts
l		2092	Entered Counts
m		2046	Entered Counts
n		2071	Entered Counts

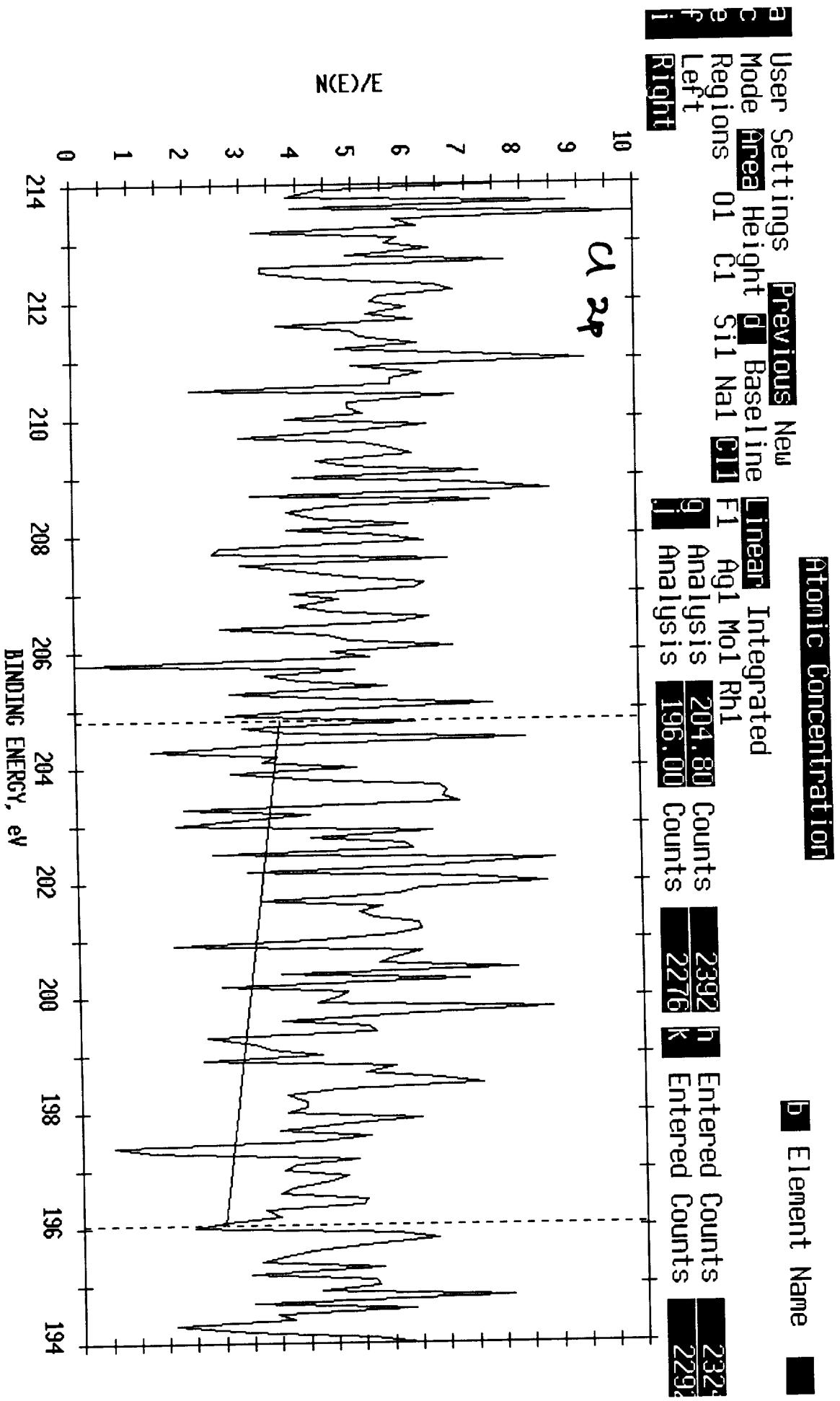


Atomic Concentration

b Element Name █

a	User Settings	Previous	New
c	Mode	Height	Baseline
e	Regions	d	Linear
f	01	C1	Si1
i	Left	Na1	C11
i	Right	F1	Ag1
i		Mg1	Mo1
i		Rh1	
g	1078.60	Counts	17996
j	Analysis	Entered Counts	1788
j	1072.00	Entered Counts	17356
k	Counts	Entered Counts	17456





C-2

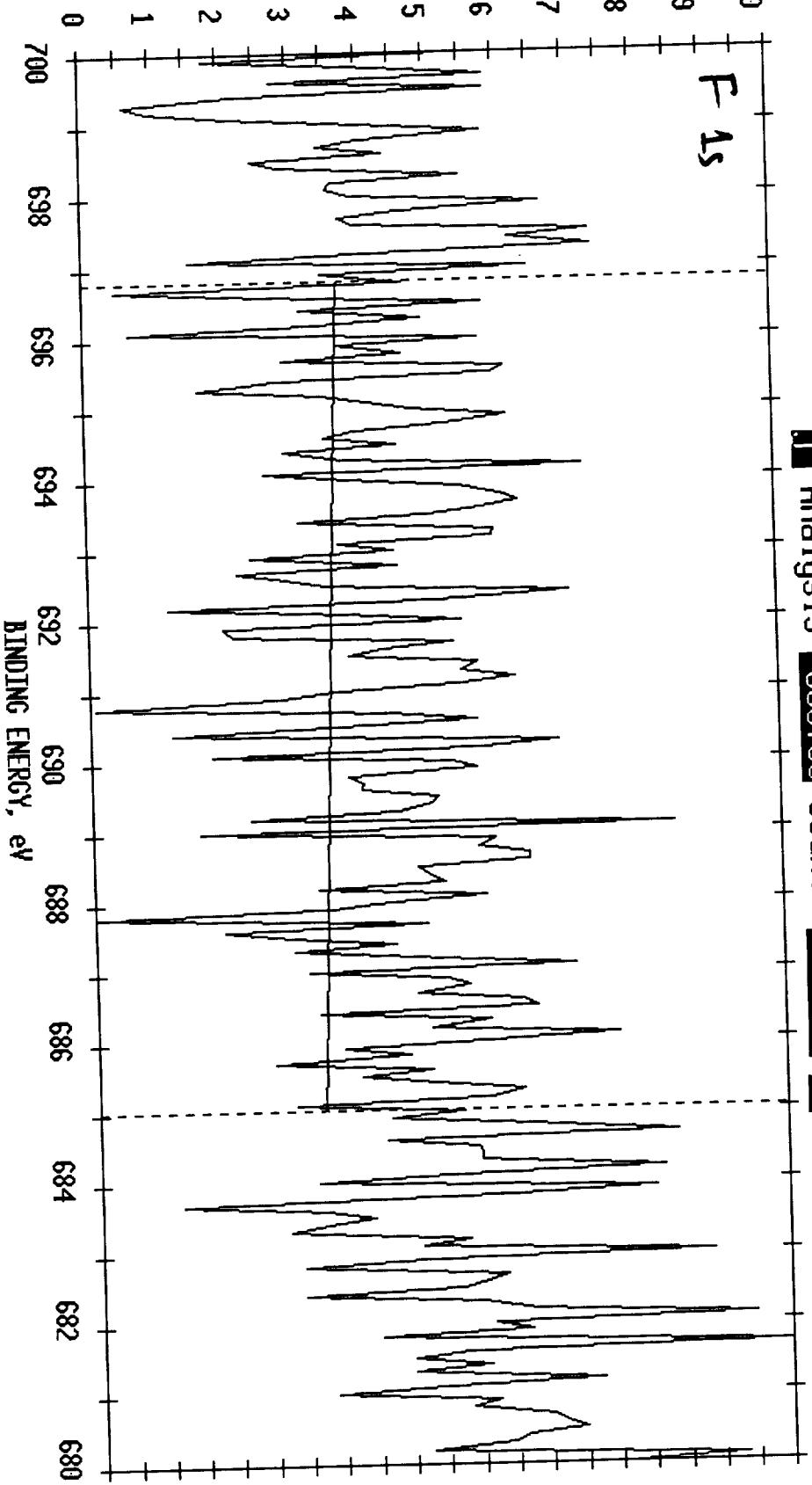
Atomic Concentration

B Element Name

a	User Settings	Previous	New
c	Mode	Height	Baseline
e	Regions	01	C1
f	Left	Si1	Na1
i	Right	C11	
d	Baseline	E1	Ag1
g	Analysis	M01	Mo1
j	Analysis	696.80	Counts
l		11086	Entered Counts
h		11124	Entered Counts
k		685.00	Entered Counts
m		11028	Entered Counts
n		11002	Entered Counts

N(E)/E

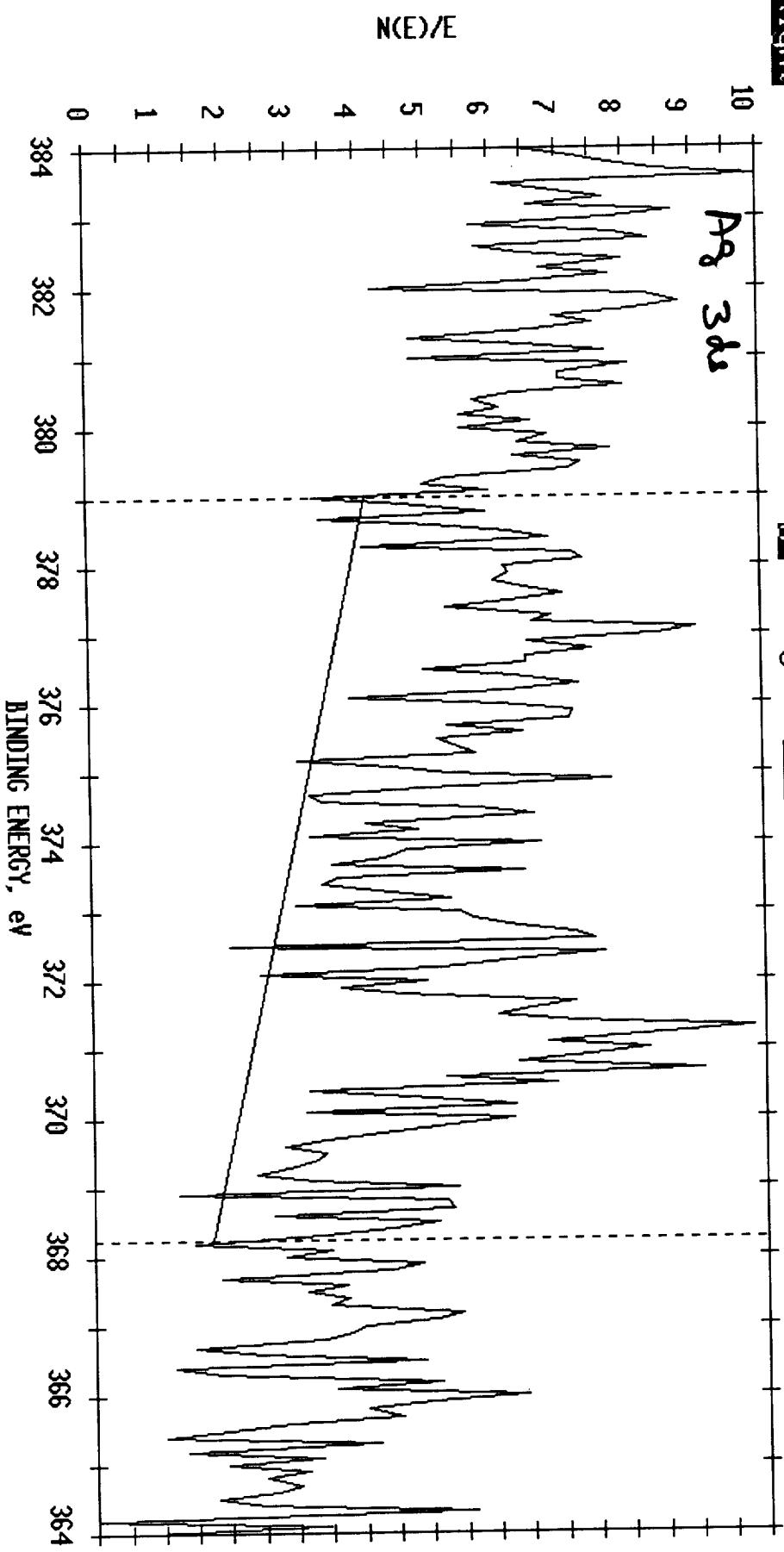
F 1s



Atomic Concentration

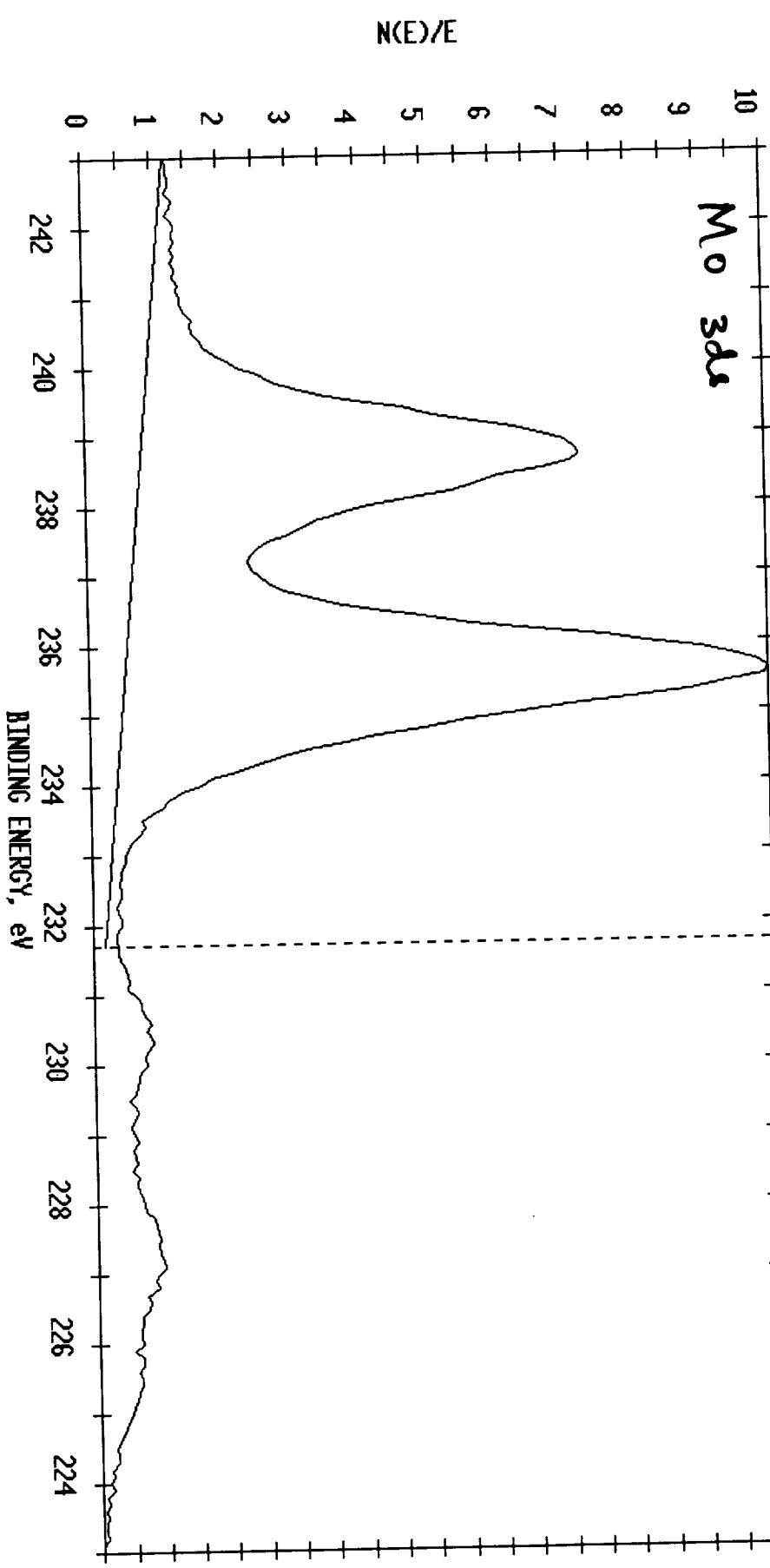
b Element Name

a	User Settings	Previous	New
c	Mode Area	Baseline	Linear
e	Regions	01 C1	Si1 Na1 C11
f	Left	F1 Ag1 Mo1 Rh1	Analysis
i	Right	379.00	Counts
j		368.20	Counts
g		6036	Entered Counts
h		5928	k Entered Counts
l		6084	5948



Atomic Concentration

a User Settings Previous New
Mode Area Height d Baseline Linear Integrated
Regions 01 C1 Si1 Na1 Cl1 F1 Ag1 Mo1 Rh1
f Left g Analysis 243.00 Counts 4200 h Entered Counts 4234
i Right j Analysis 231.70 Counts 2944 k Entered Counts 2644



b Element Name

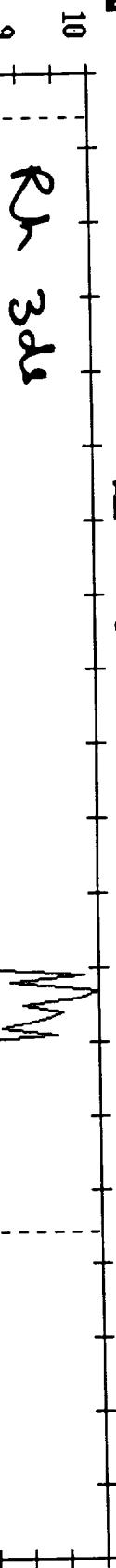
Atomic Concentration

b Element Name

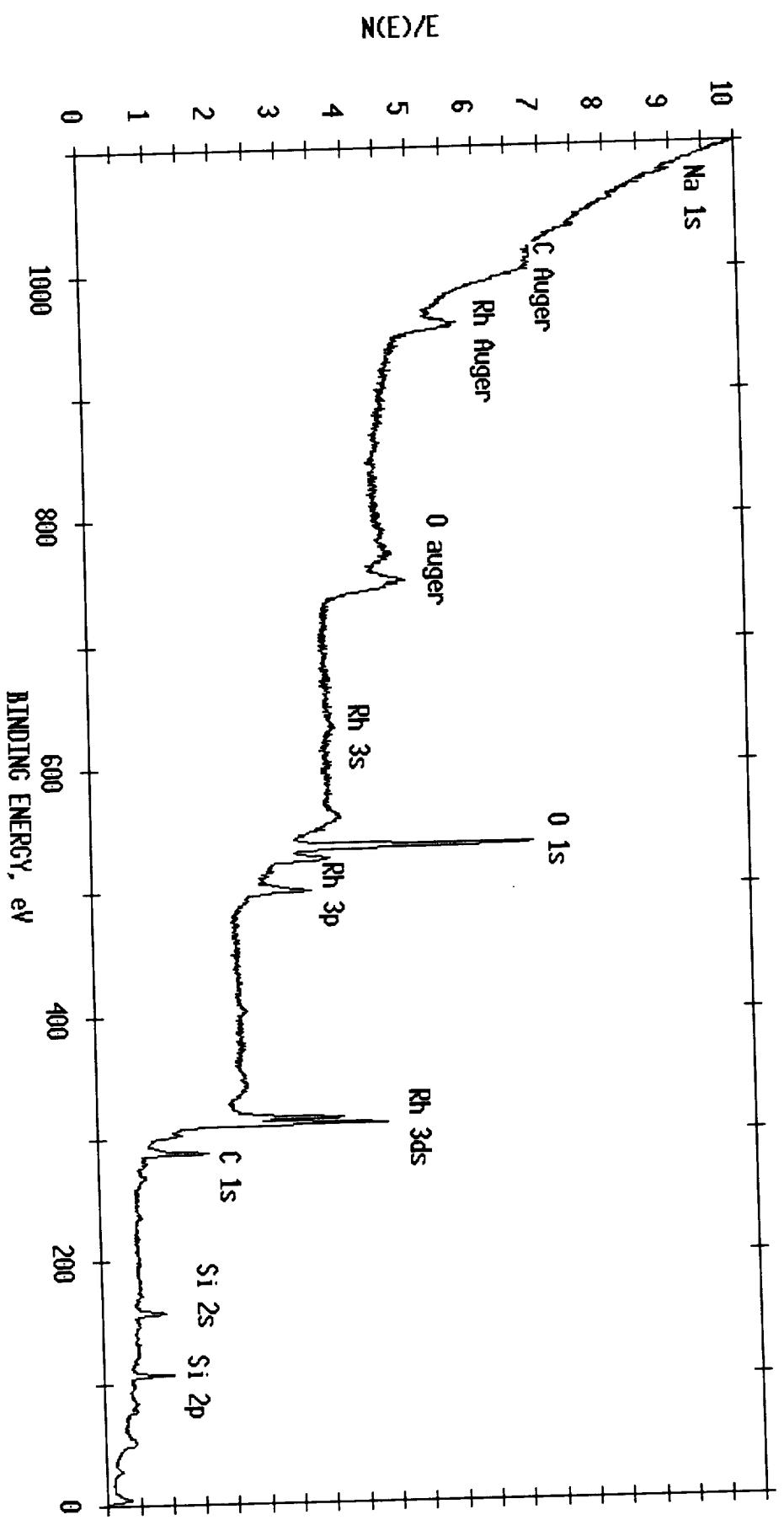
a	User Settings	Previous	New	Entered	Entered	Entered
c	Mode	Height	Baseline	Counts	Counts	Counts
e	Regions	01	C1	Si1	Na1	Mg1
f	Left					
i	Right					

d Linear Integrated
f Rh1
g Analysis
j Analysis

323.40 Counts
308.40 Counts
5382 h Entered Counts
5412 k Entered Counts
545 h Entered Counts
514 k Entered Counts



ESCA SURVEY 1/28/92 ANGLE= 45 deg ACQ TIME=4.59 min
FILE: Rh1_u_1 NASA, Rhodium LDEF, Unexposed Region
SCALE FACTOR= 26.208 k c/s, OFFSET= 5.440 k c/s PASS ENERGY= 89.450 eV Mg 250 W



Print
AC Table AC Table

Exclude
Region
Atomic Concentration
Display Curve
More Softkeys
AC to AC Summary
Exit

a User Settings Previous New
c Mode Area Height d Baseline Linear Integrated
e Regions O1 C1 Si1 Na1 Cl1 F1 Ag1 Mol Rh1

File: Rh1_u_2
Lens: Large Area Omni-Focus
NASA, Rhodium LDEF, Unexposed Region
Source: Standard

Element	Area (cts-eV/s)	Sensitivity Factor	Concentration (%)
O1s	45254	0.711	44.36
C1s	11732	0.296	27.62
Si2p	7596	0.339	15.62
Na1s	2204	1.685	0.91
Cl2p	748	0.891	0.59
F1s	2010	1.000	1.40
Ag3d	0	5.987	0.00
Mo3d	2184	3.321	0.46
Rh3d	62552	4.822	9.04

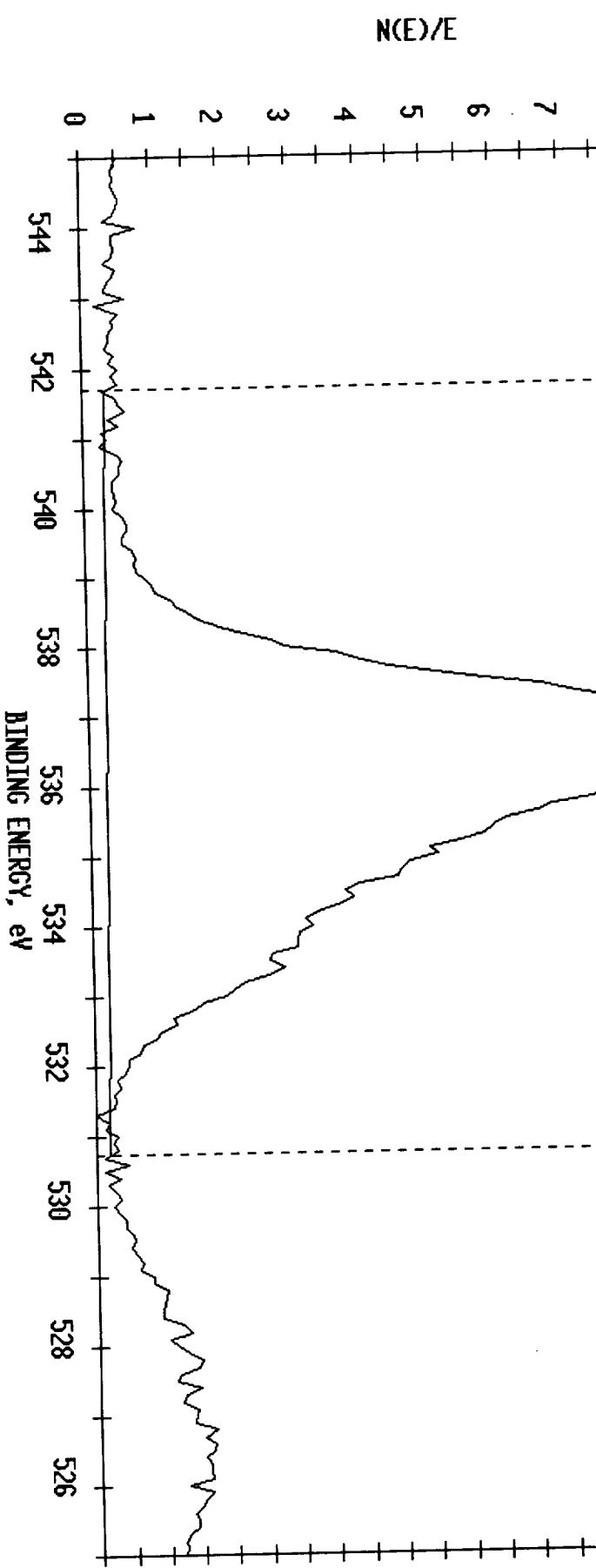
Ion Gun: OFF X-ray: ON Mg
0.5mPa

Acquiring Technique: ESCA
1/28/92 13:47

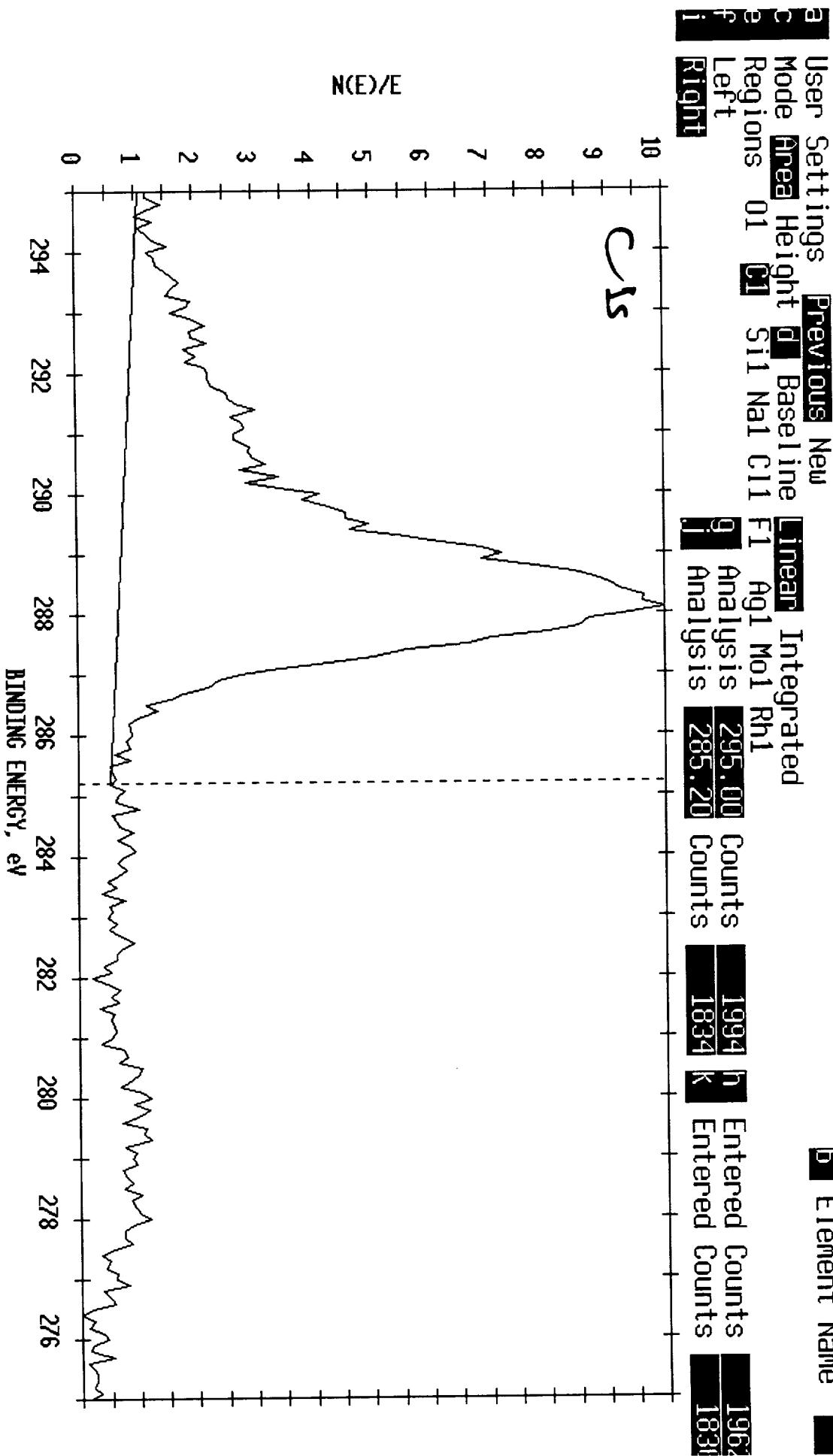
Atomic Concentration

b Element Name

a User Settings	Previous	New
c Mode Area	Baseline	Linear
e Regions	01	C1
f Left	Si1	Na1
i Right	C11	F1
	Ag1	Mo1
	Rh1	
g Analysis	541.70	Counts
j Analysis	530.70	Counts
	5886	h Entered Counts
	5750	k Entered Counts
	5890	l



Atomic Concentration



Atomic Concentration

b Element Name

a User Settings
c Mode Area Height
e Regions 01 C1
f Left
i Right

Linear

Integrated

Baseline

Ag1

Mo1

Rh1

F1

C11

Sil

C1

Si1

Na1

111.70

Counts

101.70

Counts

1418

Entered Counts

1450

Entered Counts

1365

k

Entered Counts

1365

h

Entered Counts

1450

Entered Counts

1365

g

Analysis

J

Analysis

I

Analysis

H

Analysis

G

Analysis

F

Analysis

E

Analysis

D

Analysis

C

Analysis

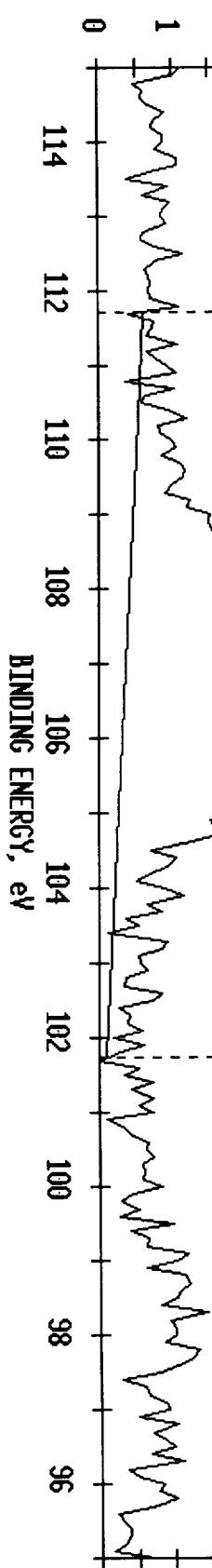
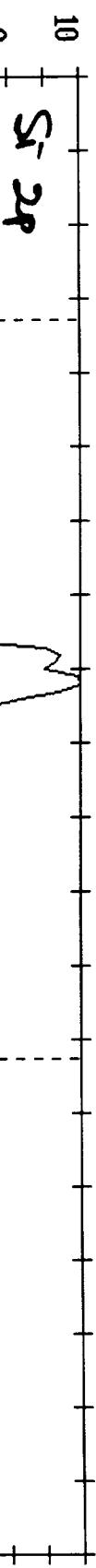
B

Analysis

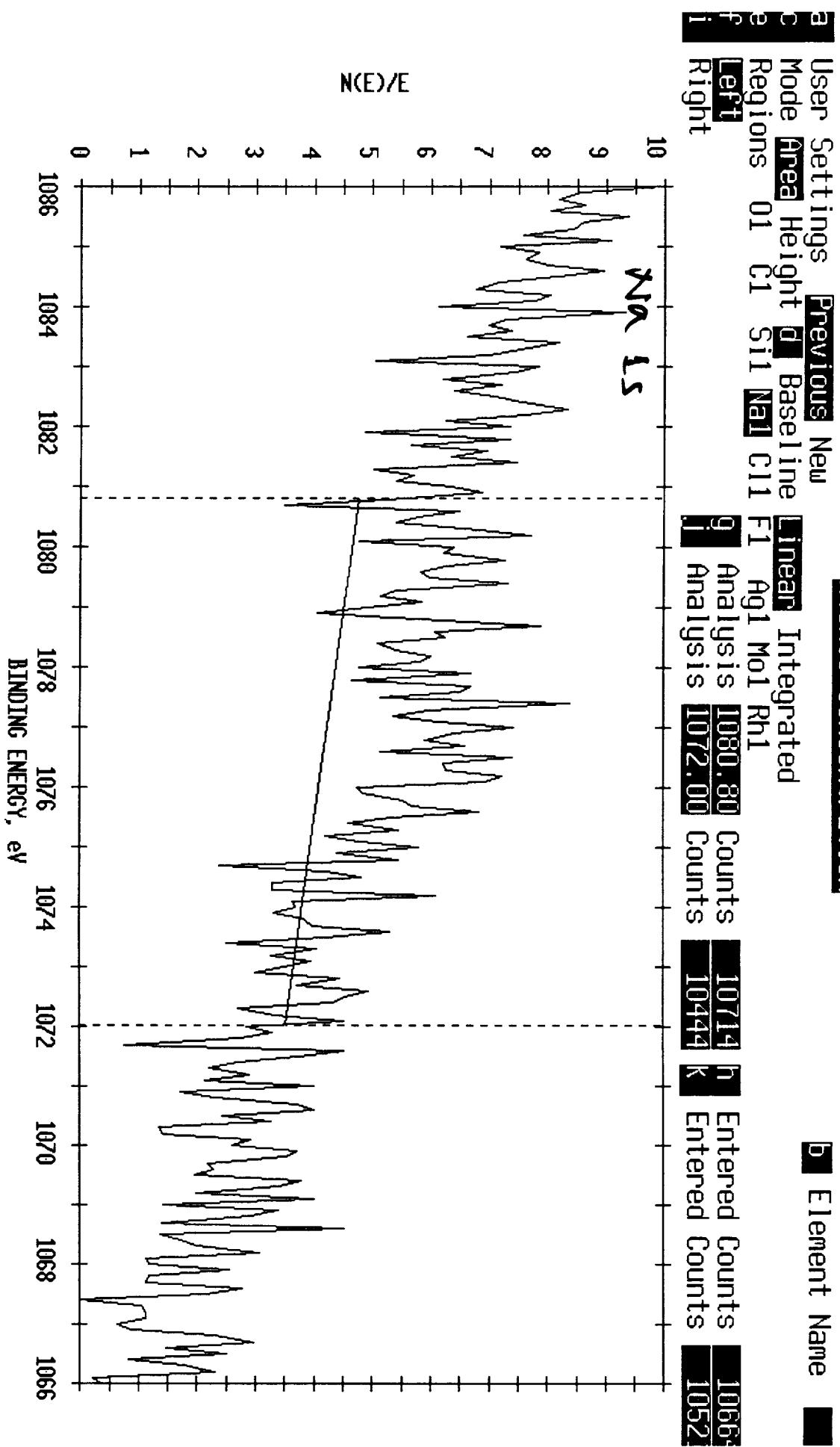
A

Analysis

N(E)/E

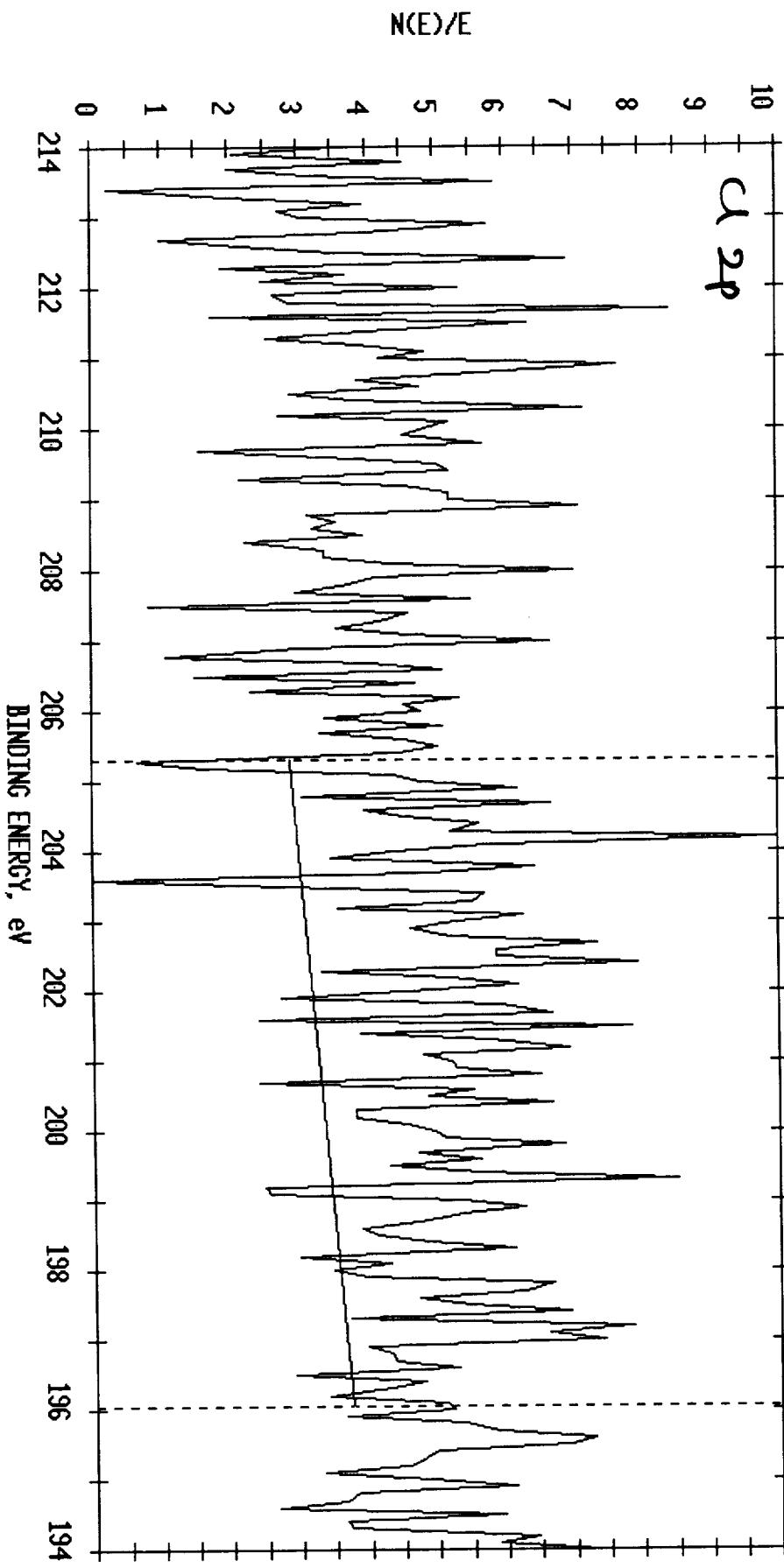


Atomic Concentration



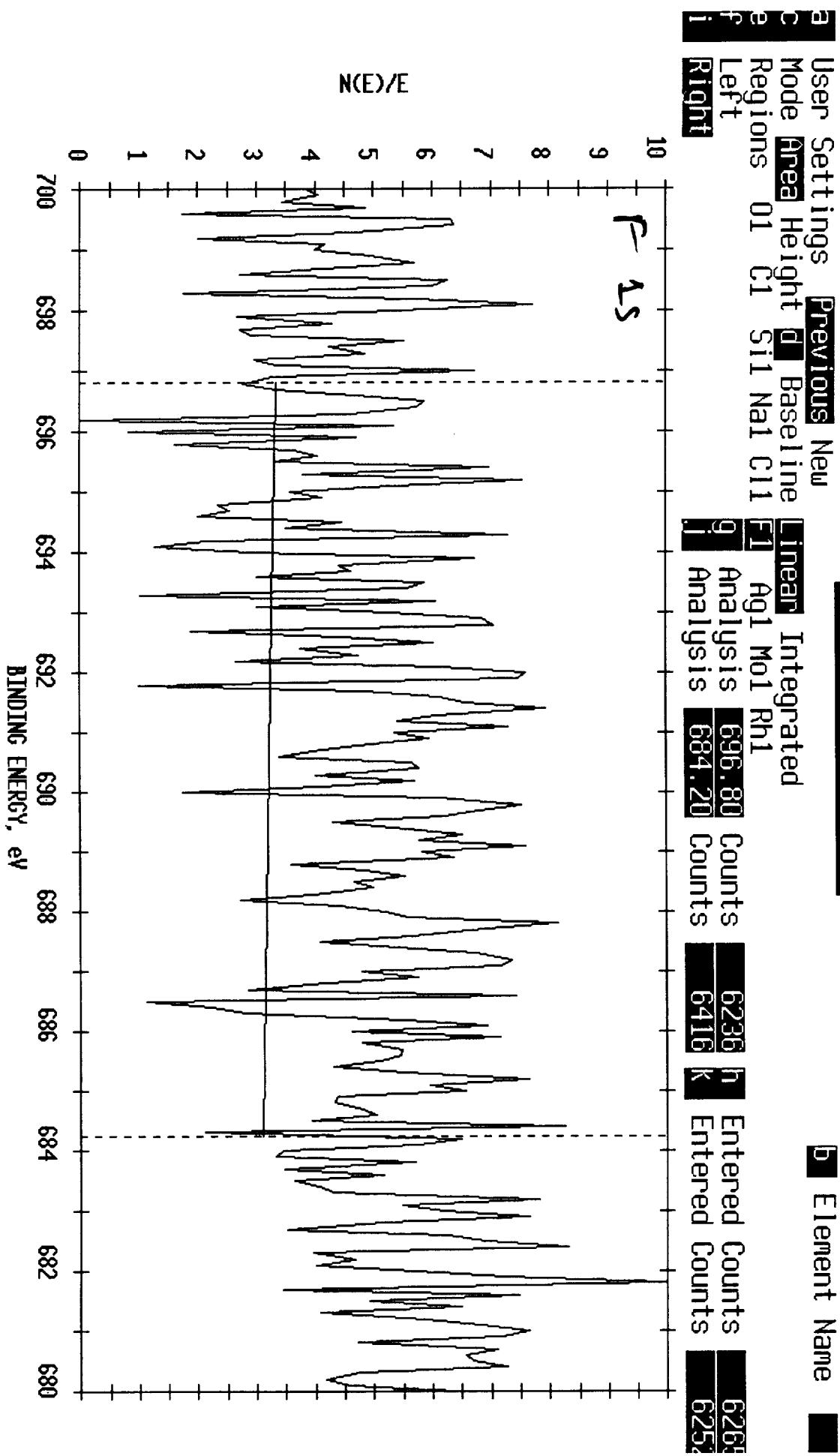
Atomic Concentration

a	User Settings	Previous	New
c	Mode	Height	d Baseline
e	Regions	01	Linear
f	Left	C1	Integrated
i	Right	Si1 Na1 Cl1	F1 Ag1 Mo1 Rh1
j	Analysis	205.30	Counts
j	Analysis	196.00	Counts
h	Entered Counts	1562	1672
k	Entered Counts	1610	163

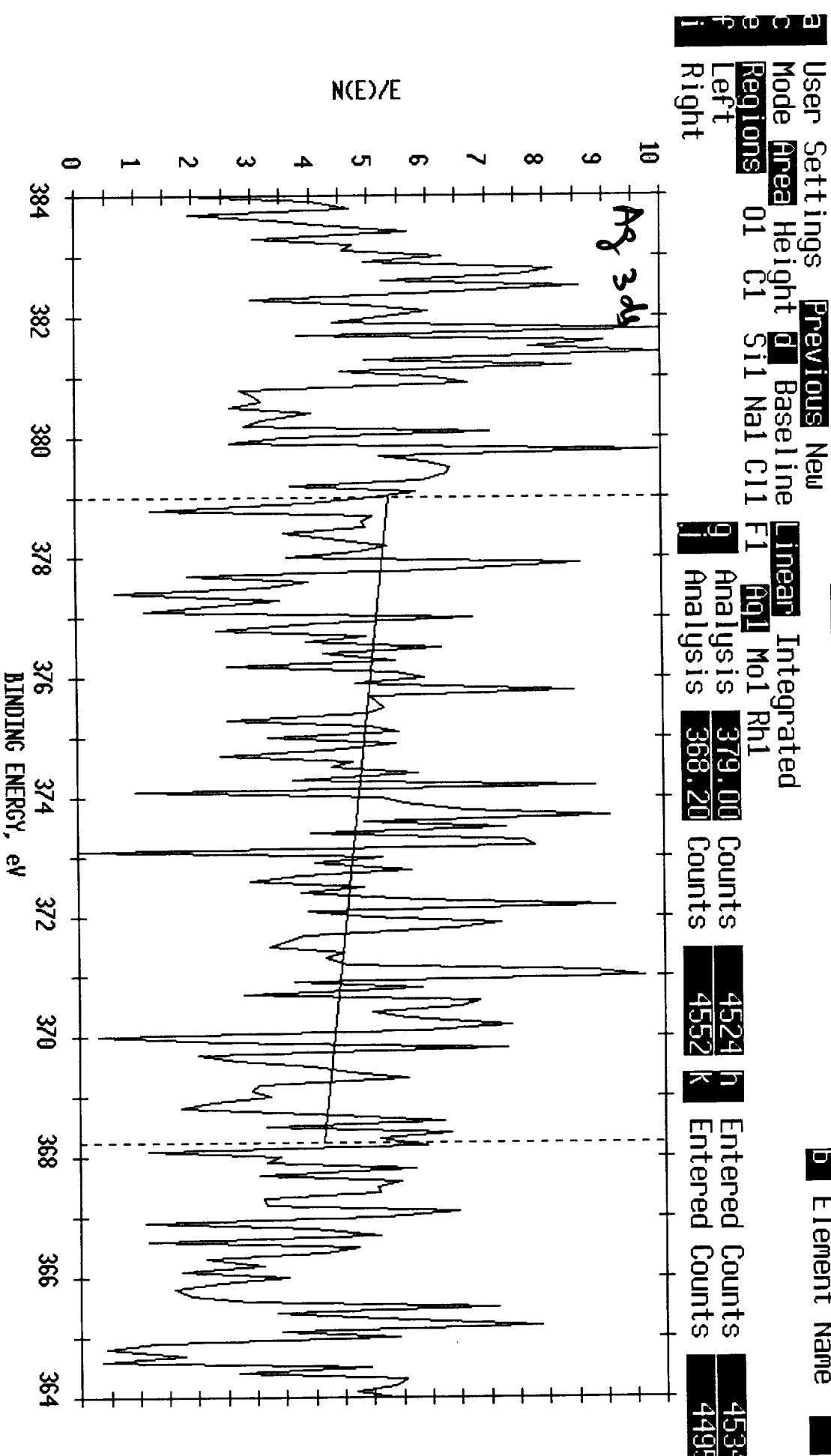


b Element Name

Atomic Concentration



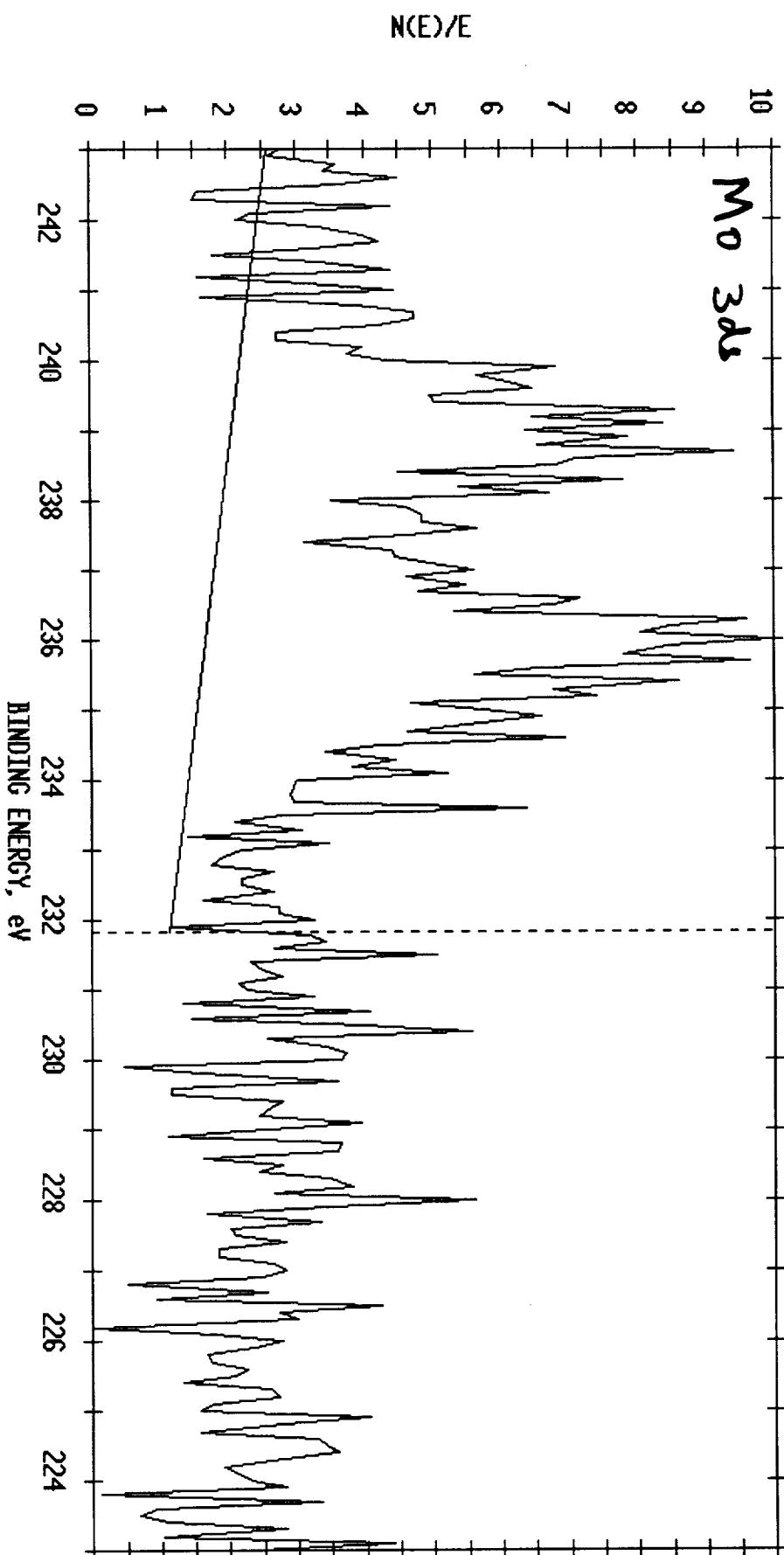
Atomic Concentration



Atomic Concentration

b Element Name █

a User Settings Previous New
Mode Area Height Baseline Linear Integrated
Regions 01 C1 Si1 Na1 C11 F1 Ag1 Mo1 Rh1
f Left Right g Analysis 243.00 Counts 1654 h Entered Counts 1668 k Entered Counts 1648



Atomic Concentration

b Element Name ■

User Settings	Previous	New
Mode	Height	Baseline
Regions	01 C1 Si1 Na1 Cl1 F1	Linear
Left	Ag1 Mo1 Rh1	Integrated
Right	323.40	Counts
j Analysis	307.90	Entered Counts
k Entered Counts	4312 h	4350
l Entered Counts	2782	267

